MODERN PLASTICS

JANUARY 1949

It pays to use your custom molder's know-how

Say the Revere Men in Rome, N. Y.

No. 1 in a series on Plastics Skill at work...

PROJECT:
Handle, whistler cap, and finger release for copper-clad tea kettle.

CUSTOMER:
Rome Manufacturing Division of Revere Copper and Brass, Inc.

MOLDER:
Norton Laboratories, Inc.

MATERIALS:
General purpose Durez phenolic in handle, steam-resistant Durez in cap, polyamide trigger.

PRECISION PLANNING improves plastic parts design. Norton development engineer uses vernier height gauge to position front assembly hole on customer's model in perfecting new handle.

CREATIVE ENGINEERING speeds output, lowers cost. Duplex ram plunger press remodeled by molder cuts cure time. Shrink fixture in foreground assures accurate assembly, prevents waste.

● Next time your plans suggest consideration of plastics, why not call in your custom molder early — when he can serve you to best effect?

Example: Tools of a good housekeeper's "dream kitchen", a new line of Copper-Clad Stainless Steel Revere Ware shows the value of having experienced plastics molders cooperate in product development.

With a good idea ready for the final touches, Revere officials called in Norton engineers. Special skill in custom molding enabled Norton to make constructive design suggestions for product betterment. Then, they devised special production equipment that multiplies output several-fold and assures precision fit in assembly.

Durez phenolics, impervious to boiling water, light weight, and of lustrous, heat-resistant finish, provide desired qualities in the handle and cap.

As specialists in the phenolics since the industry's earliest days, Durez field engineers, too, can bring the authority of experience to your problems.

At any stage in your product plans, from the basic idea onward, we will welcome your invitation to assist.

A new bit with plastics users everywhere is the handy "Durez Check-Chart." Write for yours. Durez Plastics & Chemicals, Inc., 321 Walck Rd., N. Tonawanda, N. Y.

DUREZ

PHENOLIC RESINS

- MOLDING COMPOUNDS
- INDUSTRIAL RESINS
- PROTECTIVE COATING RESINS

PHENOLIC PLASTICS THAT FIT THE JOB

TECHNOLOGY DEPARTMENT

THE FRAGRANCE APPEAL OF YARDLEY . . . THE DISPLAY APPEAL OF Catalin

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DETROIT

At perfume counters — where women rendezvous . . . and where fragrances vie continuously for feminine favor — most impressively stands Yardley's selected trio of essences . . . enthroned in Catalin.

Brilliant china red Catalin . . . genteel ivory Catalin . . . rich jet black Catalin — custom designed and combined in a manner that commands attention . . . catches the eye . . . and subtly proffers itself to sampling fingers. Thus, does it accomplish its sales mission!

An ingenious provision in the Catalin bases locks each individual flacon in a non-removable position . . . a feature necessary to an otherwise generous sales motivating, pre-sampling gesture.

In the realms of display, as in all fields, the use of Catalin creates an incomparable beauty of form — and of color. Its effect, one of luxury and quality, is also one of prestige, economically achieved . . . because very often stock sheets, rods, tubes or shapes can be effectively assembled into display units requiring no mold costs and very little fabrication.

Whether produced from available stock shapes or cast to customer specifications, the use of Catalin offers greater design flexibility — low tooling-up costs.

To gain the touch that is one of incomparable beauty, investigate Catalin for your next display or product projection. Our service staff will welcome the pleasure of assisting you. Inquiries invited!

CATALIN CORPORATION OF AMERICA
ONE PARK AVENUE • NEW YORK 16, N. Y

Yardley counter display fabricated by
Krest Mfg. Co., Inc., So. Norwalk, Conn.

CATALIN
THE GEM ST
PLASTICS
Catalin

CAST RESINS • LIQUID RESINS • MOLDING COMPOUNDS

MODERN PLASTICS*

VOLUME 26 JANUARY 1949 NUMBER 5

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*Reg. U. S. Patent Office.

Now-pennies put glamour in your wife's workshop!

Marvalon, made by the Munising Paper Company, Chicago, Ill.

TRUST the little woman to pretty-up the place she spends a lot of time in. Trust her, too, to discover a material for her kitchen that's high in glamour, low in cost and has dozens of uses.

That's why she chooses Marvalon, the amazing new decorative material that can be used for shelving and table covers as shown in the picture of the glamourized kitchen. It is made from reinforced cellulose fibre and coated with Geon polyvinyl chloride resin.

The novel idea of coating reinforced cellulose fibres with Geon gives Marvalon its amazing range of qualities that make it so useful. It won't crack, peel or fray. It is stain resistant, odorless and so easily washable—tough enough for wall covers. The skillful use of Geon in this new development opens up possibilities for new products and improvements in others. Perhaps it will give you an idea. If so, tell us and we will send you information on how Geon polyvinyl materials might be used for your product.

Remember, we make no finished products from any of the raw materials we manufacture. We invite you, however, to take advantage of our technical service for any problems or special applications you may have in mind. Write to B. F. Goodrich Chemical Company, Dept. N-1, Rose Building, Cleveland 15, Ohio. In Canada: Kitchener, Ont.

B. F. Goodrich Chemical Company A DIVISION OF THE B. F. GOODRICH COMPANY

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers

BY CHICAGO MOLDED PLASTICS

The new UARCO FM Portable Autographic Register offers another good sample of the way in which molded plastics can improve the utility and appearance of a product and, at the same time, lower the cost.

One of the prime requirements of the housing for this item is minimum weight. With this, however, must be coupled strength and durability. To accomplish this, UARCO makes the cover of heavy gauge aluminum. The body is molded of extra strength phenolic material by Chicago Molded.

Here we have the ideal combination . . . a light weight housing that has all the rugged strength needed to withstand the wear and tear that a portable unit invariably received. It's good looking, too. The anodyzed aluminum cover forms a pleasing contrast with the gleaming black of the molded plastics body.

Mighty important, also, is the cost. Because the body is molded of plastics, this complex shape, complete with its lugs, bosses, and partitions is formed in a single operation. Assembly time is reduced to a new low and there is no finish to be applied. As a result, UARCO is able to sell this new unit at a lower price than its predecessor . . . and that in the face of rising production costs.

Yes, it's a Chicago Molded job throughout . . . engineering, mold-making, molding and finishing. It's typical of the work Chicago Molded is doing for leaders of industry . . . and has been doing for more than a quarter century. Perhaps it gives you an idea of how molded plastics might be utilized to improve your product and lower its cost. Why not talk it over with a CMPC Development Engineer? There's no obligation. Phone or write.

CHICAGO MOLDED PRODUCTS CORPORATION

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COMPRESSION *and* **INJECTION** *molding of all plastic materials*

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EDITORIAL

From Pre-War to Post-War

Fiorello LaGuardia was mayor of New York—ditto Ed Kelly of Chicago; there were two Thanksgiving days; Admiral Leahy was appointed Ambassador to Vichy France; Brehon Somervell went back to the Army after a tour as W.P.A. administrator in New York; the British won the Battle of Britain; Gallahadion initiated a decade of upsets by winning the Kentucky Derby; and the plastics industry sold about 115,000,000 lb. of molding compound.

That was the year 1940.

In 1948, business was still booming at a high level despite fears of the Jeremiahs; more persons had jobs than ever before in peace-time; inventories were bursting at the seams; the stock market refused to advance; the Army football team *almost* got beat; Truman upset the pollsters; and more than 500,000,000 lb. of molding and extrusion compound were sold by the plastics industry.

This has not been the spectacular growth that dreamers and uninformed columnists asserted would make plastics provide a livelihood and profits for millions of people after the war. Nevertheless, it is a solid contribution to American industry, to which plastics have supplied a whole new and still growing family of tools with which to work.

There are several significant factors in plastics' growth that should become more distinctive as we go into 1949. Although molding and extrusion compounds are now the dominant factor insofar as chief outlet is concerned, the sum total of all other uses may grow even faster than the molding branch. Applications in adhesives, laminating, calendering, coating, and uses of resin or cellulosics for textile and paper treatment as well as with wood waste, could eventually become the plastics industry's greatest contributions to the nation's welfare.

In the molding and extrusion industry alone, great significance attaches to the ever-growing prominence of thermoplastics which in 1948 exceeded thermosetting molding compound consumption for the first time in history. Leader in this march is polystyrene, which came within 30,000,000 lb. (two month's production) of equaling the phenolic total for the year. And the improvement being made in the properties of this already versatile material are certain to broaden its adaptability for wider markets. Vinyls, too, have added large volume to the extrusion industry, to say nothing of their molding potentialities.

All signs indicate that the thermoplastics' sun will become bigger and brighter as it makes its arch over the plastics sky in 1949, and that few clouds will appear to even threaten its brilliance.

If You Need punched parts of laminated plastics by the MILLION

Look to RICHARDSON
Insist on INSUROK

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The Richardson Company offers you the services of an established, experienced, manufacturing organization with ample facilities for quantity production of Laminated **INSUROK,** proven by years of experience to be one of the world's truly fine punching stocks.

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Saves weight on planes . . . boats and trains, too!

IN KITCHEN OR GALLEY, this sink of "Lucite" lessens the load. It's formed by a combination of processes—pressing, vacuum-drawing and blowing. "Lucite" is not affected by citrus and other food acids . . . resists most chemicals, heat and aging, and it's easy to maintain. Week after week, manufacturers are bringing out new or improved products of "Lucite."

Soon you may be seeing basins like this—almost any way you travel. For fixtures made of "Lucite" are excellent wherever deadload must be kept light . . . on aircraft, water-craft, trailers and trains.

Weighing only 7¼ lbs., without fittings, this basin of "Lucite" acrylic resin combines colorful, gleaming beauty with dependable durability. Tests show that the basin withstands hot water—has excellent dimensional stability, is resilient and shatter-resistant.

For other applications, manufacturers prefer "Lucite" because of its weather-resistance, its crystal-clarity (transmits up to 92% of visible light) and the ability to "pipe" light around corners. "Lucite" is available in many colors—transparent, translucent and opaque. What's more, it's readily fabricated or molded.

How about *your* products? Perhaps you will profit with "Lucite" or another Du Pont plastic . . . in developing a new product or improving an old one. Write for literature. E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Room 361, Arlington, N. J.

Basin and sink manufactured by American Plastic Products, Inc., Millburn, New Jersey.

Tune in to Du Pont "CAVALCADE OF AMERICA," *Monday nights—NBC coast to coast.*

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Plastics
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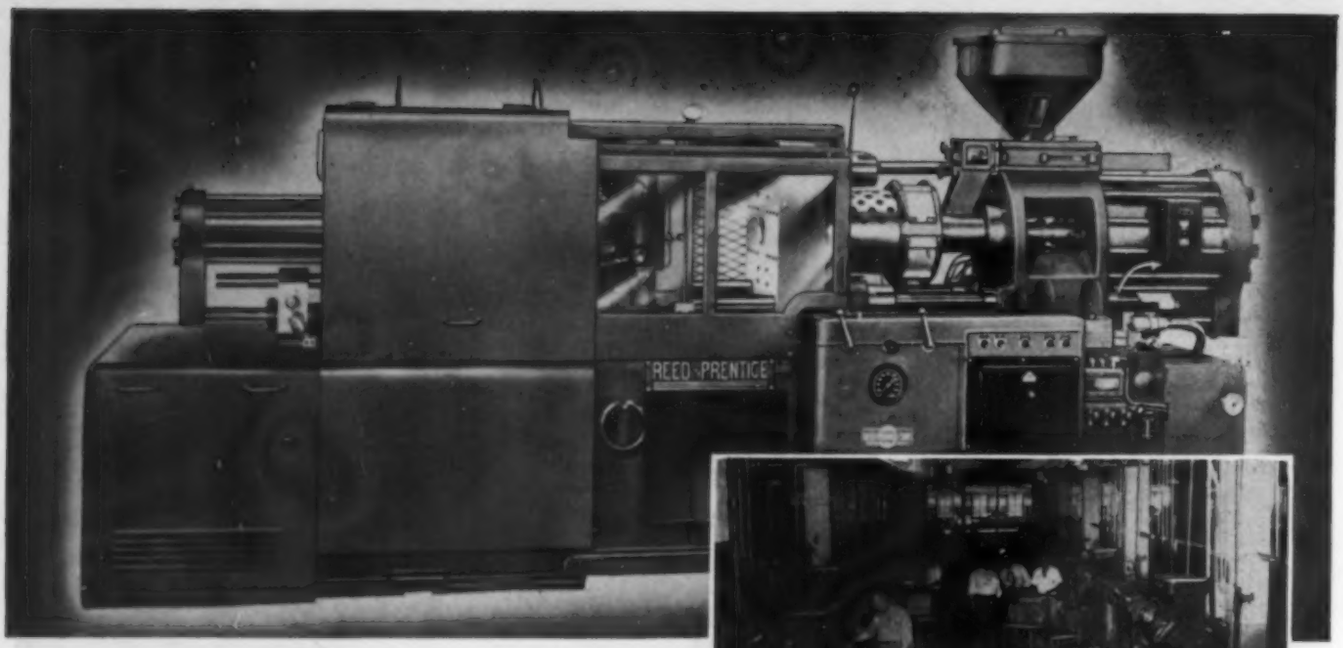
THROUGH CHEMISTRY



PERFORMANCE is the FINAL PROOF!

Reed-Prentice Injection Machines Help Another Plant to Grow!

The modern plant of the Bay Mfg. Div.—Electric Auto-lite Corp., Bay City, Michigan, has grown steadily from their first Reed-Prentice plastic injection machine to an imposing installation of 33 injection machines, 28 of which are the 10D-8 Oz. model.

Installations like this, provide indisputable evidence of the outstanding record of Reed-Prentice equipment for dependable service and economical maintenance . . . as well as unquestioned proof of the popularity of the 10D-8 Oz. machine for medium capacity injection molding.

Provided with accurate controls to govern every phase of the molding cycle, the 10D-8 Oz. (like other models) features the new Reed-Prentice heating cylinder with special alloy steel, chrome plated spreader and solid copper core, that plasticizes material up to 20% faster.

You, too, can have continuous, un-interrupted production in your plant . . . the kind of versatile machine operation that means PROFITS! You'll find a capacity to fit your molding needs in the complete Reed-Prentice line. Write Dept. D for specifications and full information on the 4, 8, 10, 12, 16, 24 and 32 Oz. models.

10D-8 Oz. Specifications

Die locking pressure, tons	250
Max. casting area, sq. in.	100
Mold opens	10¼"
Max. die space	16"
Size: die plates	21 x 25"
Oz. molded per shot (acetate)	8
Pressure psi on material	20,000

INJECTION
REED-PRENTICE CORP.
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What's the Difference...

between LUMARITH* XF and Standard Cellulose Acetate?

A. Lumarith XF has 50 to 80 percent greater flame resistance.

Q. Are there other differences?

A. Yes, Lumarith XF has 25 percent greater impact strength than regular acetate. It is a hard flow formulation with an excellent balance of physical characteristics—including: heat resistance, form retention, resistance to cold flow and surface brilliance. Lumarith is available in a full color range that stops just short of crystal transparency.

Q. What does Lumarith XF have to offer the manufacturer of electrical parts and products?

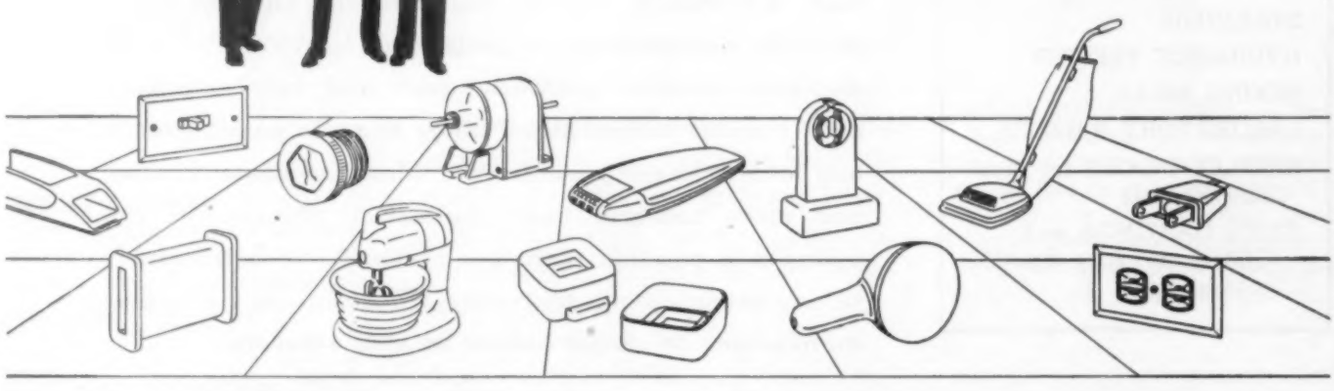
A. Lumarith XF has been developed especially for the electrical and appliance industry. It is a thermoplastic. That means it is moldable by high speed injection and extrusion . . . can cut production and finishing costs considerably. Its impact and tensile strength can produce parts of greater toughness and serviceability. Lumarith XF is available in a full color and transparency range. It is completely machinable without annealing.

Q. What about Underwriters' approval?

A. Products using Lumarith* XF are receiving Underwriters' Laboratories approval.

Q. How can we know that Lumarith XF will work for our products?

A. Celanese offers its cooperation in testing and developing Lumarith XF in new applications. Case histories of successful switchovers to Lumarith XF are available for study by manufacturers and product planners. Write. Celanese Corporation of America, Plastics Division, Dept. D-1, 180 Madison Avenue, New York 16, N. Y.



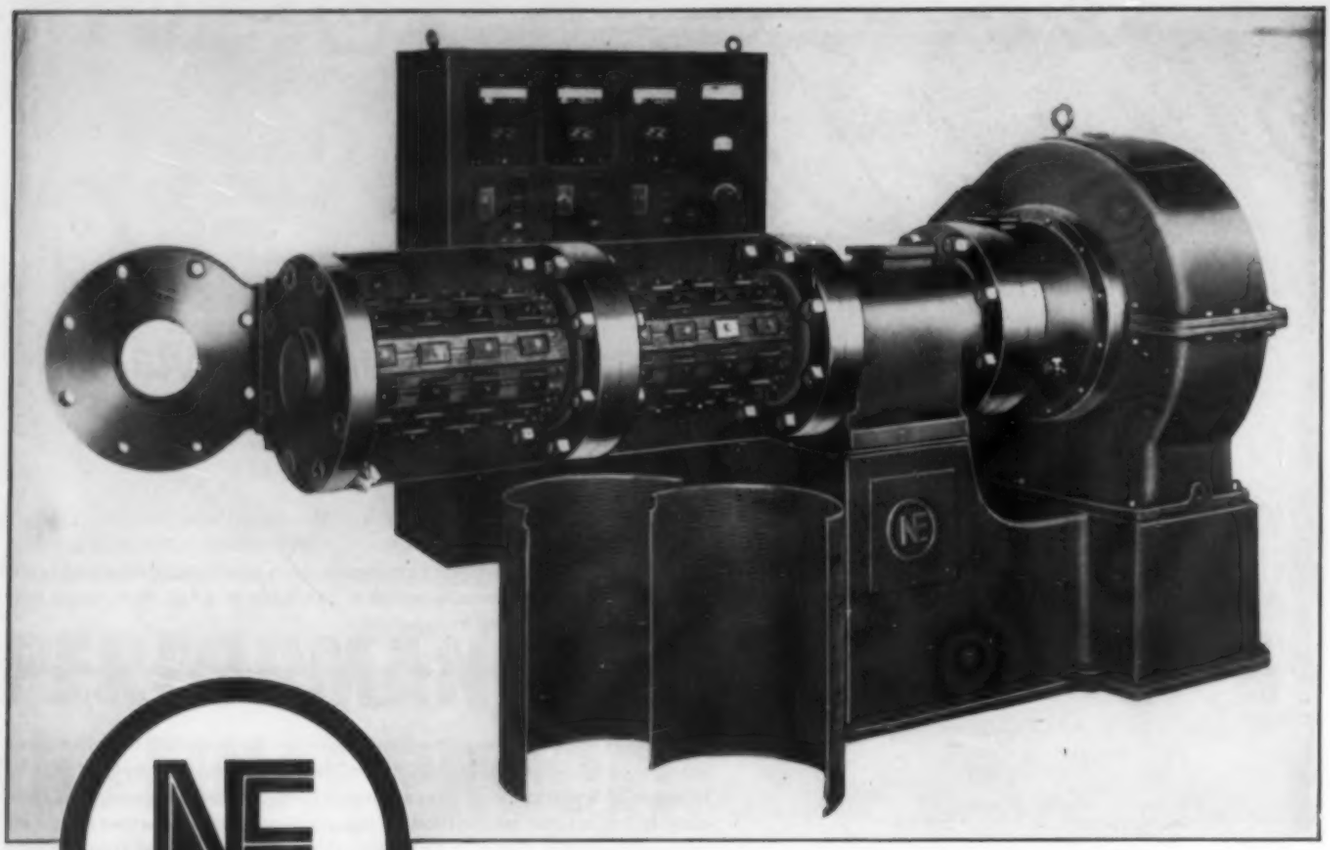
IF YOUR PRODUCTS CAN

benefit *costwise* through injection or extrusion molding
benefit *productwise* through toughness, color, and finish
benefit *safetywise* through greater flame and heat resistance

LOOK INTO LUMARITH* XF

A *Celanese* Plastic

*Reg. U. S. Pat. Off.



presents **NEW LINE OF ELECTRICALLY HEATED EXTRUDERS—THE ANSWER TO PROCESSING HIGH TEMPERATURE PLASTICS**

NE Products

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STRAINERS
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MIXING MILLS
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STEEL CASTINGS and GEARS to Any Specifications.

THE above NE extruder features direct contact, electrically heated cylinders for the extrusion of high temperature plastics—up to 750° F. This electrical method provides clean and safe operation over a wider temperature range than is possible with any other heating medium. More accurate control and more uniform heat application throughout the cylinder is possible with this method. It is adaptable to any extruder. Consult with NE engineers for recommendations on electric heating for your extruders.

• *Write for copy of our general catalog that fully describes NE Extruder's 5-unit construction.*

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ERIE, PENNSYLVANIA • U. S. A.

STABILITY . . . Marvinol VR-10 is superior in resistance to heat, light and other normally destructive factors.

VERSATILITY . . . Marvinol VR-10 is easy to process . . . may be calendered, extruded, injection molded, used in non-aqueous dispersions, formulated as unplasticized rigids . . . uniquely versatile.

TOUGHNESS . . . Marvinol's high molecular weight offers you extra toughness and "dryness" with long life . . . resists tear, wear, oils, acids.

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EASILY CLEANED . . . Marvinol-based products are easily and quickly cleaned because of their smooth surface. They're waterproofed, unaffected by mold or fungi.

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"BETTER PRODUCTS, GREATER PROGRESS, ARE MADE BY MARTIN"

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Award Winner—Housewares Classification—as used in fine old American Home where gracious living and sturdiness meet in the "American manner"

Canister Sets, Refrigerator Bowls, Cups, Saucers, Pitcher, Creamer, Sugar Bowl, Wonder Bowl with cover and Tumblers are

Tupperware

by

Tupper Corporation

Silver, napery, cutlery, glassware, etc., by others

The Penalty of Leadership

Once, quite a long time ago, an advertisement was written about a very fine automobile. This car was just about the finest of its time . . . it still is, in the consideration of lots of folks.

The caption of that advertisement was the same as this, and among the thoughts expressed was that whenever an individual, an institution or a product has attained such a position, they, or it are in constant competition with themselves.

A position such as this immediately establishes a code of behavior, less than which it is impossible to contemplate. All, occupying this place are bound by this code to become stewards—guardians of sharply defined ideals and principles. Intimate association is possible only with others of comparable stature.

It's no easy position, this one of Leadership. There are temptations . . . constant and insidious, against which there must be unceasing watchfulness and which must be courageously met and sternly and decisively rebuked.

And so, because the story of the ideals that produced a great car and a great organization so closely parallels our own, we liken ourselves, our product and our anticipated future activities to it.

For, when TUPPERWARE is designated as the winner of the only award possible to bestow in its group classification . . . one from among thousands, then are we indeed worthy to put on the mantle of a Leader.

And that this mantle may never lose its significance, it is a natural sequence that we, as custom molders of fine plastics may only serve other comparably fine products, secure in the mutual assurance that they and we will retain our respective positions through such association.

A communication addressed here may very well initiate a joining of the "winning ways" of Tupper with your own excellent product, to the everlasting credit of both.

TUPPER

TUPPER CORPORATION

FACTORIES: Farnumsville, Mass., and Cuero, Texas **New York Show Rooms 225 Fifth Ave.**

ADDRESS ALL COMMUNICATIONS TO: Development Department D, CUERO, TEXAS

IF YOU MAKE

PLASTICS

DIE CASTINGS

STAMPINGS

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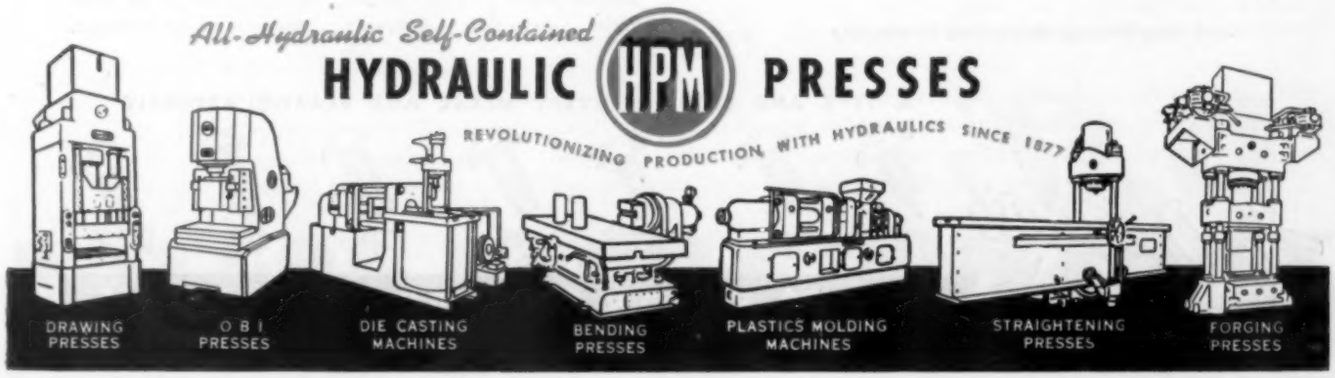
1010 Marion Road — Mount Gilead, Ohio, U. S. A.

All-Hydraulic Self-Contained

HYDRAULIC HPM PRESSES

REVOLUTIONIZING PRODUCTION WITH HYDRAULICS SINCE 1877



COMMON SENSE ASSEMBLY ENGINEERING

Puts Fastening Costs in a Better Light

MAKES PARKER-KALON TYPE Z SERVE DUAL PURPOSE . . . SAVES 35%

To make the price of these adjustable fixtures as practical as the lamp itself, the manufacturer—**Penetray Corp., Toledo, Ohio**—had to "go light" on fastening costs. That meant fast assembly with as few operations as possible.

But the fasteners had to serve a dual purpose . . . attach the plastic Hemisphere socket to the fixture's metal base (or gooseneck) and function as pivots to permit a 180° sweep of the socket.

P-K Self-tapping Screws were selected because they not only eliminated troublesome tapping and tap breakage, but also provided the hardened tips of the screws to serve as long-wearing pivots. Thus, they permitted a simpler, smoother design, and helped brighten the cost picture with a 35% assembly saving!

Why not examine your own fastening methods in the light of common sense assembly engineering. Very likely you, too, can benefit by switching to the simpler Parker-Kalon method. Call in a P-K Assembly Engineer. He can show you that in 7 out of 10 cases, use of P-K Self-tapping Screws saves up to 50% in assembly work hours. If you prefer, mail assembly details for recommendations. Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.

Sold Only Through Accredited Distributors

Two P-K Countersunk Oval Head Type "Z" Self-tapping Screws fasten plastic socket to metal base of fixture and also serve as pivots for Hemisphere socket which moves 180° in a vertical plane. P-K Screws need only to be driven in plain holes . . . form their own threads . . . assure a strong fastening.

P-K® The Original

A TYPE AND SIZE FOR EVERY METAL AND PLASTIC ASSEMBLY

PARKER-KALON SELF-TAPPING SCREWS

PARKER-KALON PRODUCTS COLD-FORGED SOCKET SCREWS, WING NUTS, THUMB SCREWS • HARDENED SCREWNAILS AND MASONRY NAILS
SHUR-GRIP FILE AND SOLDER IRON HANDLES • METAL PUNCHES • DAMPER REGULATORS AND ACCESSORIES

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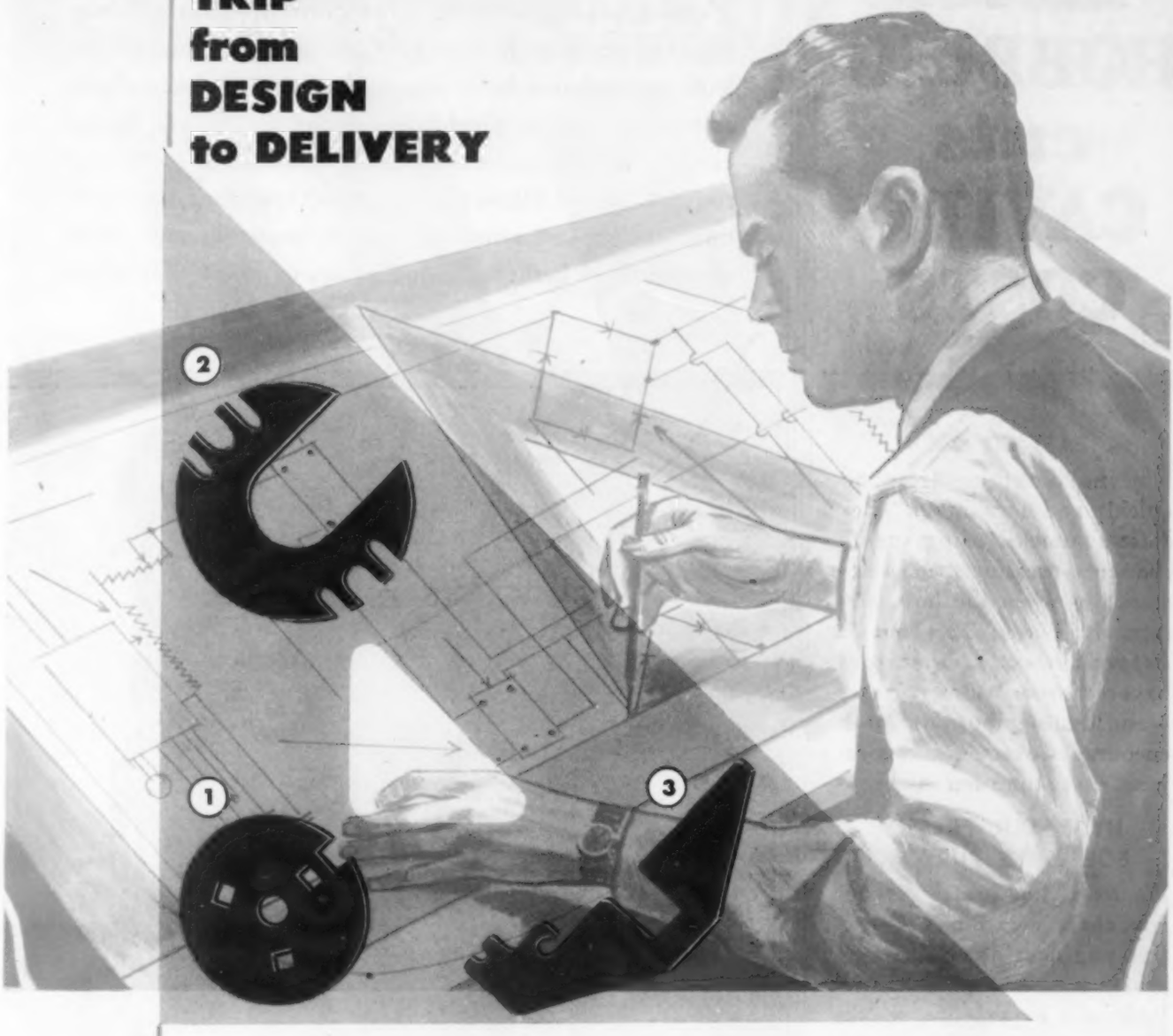


As insulating parts and structural members, Taylor Phenol Fibre and Taylor Vulcanized Fibre have literally hundreds of applications in the electrical industry.

Not the least of their advantages is the speed and versatility of fabrication. Sheets, rods, and tubes of Taylor Laminated Plastics machine with such ease, and such precision, that parts can usually be delivered to stock rooms well in advance of requirements . . . helping to solve many a production headache.

If you do your own fabricating, Taylor can supply you with Phenol Fibre, Vulcanized Fibre, or special formulations . . . *and* with valuable advice to increase the speed of your production.

1. **Contact insulation washer, stamped from Taylor Phenol Fibre sheet.**
2. **Switch insulator, stamped from Taylor Vulcanized Fibre sheet.**
3. **Support member, stamped from Taylor Phenol Fibre sheet.**

If you seek a source of supply for finished parts, Taylor again is your answer. Taylor's completely equipped Fabricating Service is always at your call.

Whatever your problem, mechanical or electrical, our engineers will be glad to tell you exactly what Taylor can do for you. Write today, sending sketch or blueprint.

TAYLOR FIBRE COMPANY

LAMINATED PLASTICS: PHENOL FIBRE • VULCANIZED FIBRE • Sheets, Rods, Tubes, and Fabricated Parts

NORRISTOWN, PENNA. **Offices in Principal Cities** **Pacific Coast Plant: LA VERNE, CAL.**

ELMES HOBBING *cuts* CAVITY COSTS

Power, plus precision, plus control—that's *Elmes* hobbing presses—in sizes to 5,000 tons, and larger, for sinking hardened hobs into cold steel. It's the modern, *economical* way to produce duplicate die inserts, multi-cavities—even single-cavity molds with hard-to-make contours. Compact Elmes presses, with their rigid three-column design and sensitive control, assure precise, accurate work—whether it's one cavity, or many just alike.

EASY TO USE

Elmes hobbing presses respond quickly and unfailingly. They start at quick-closing speed; change to pressing speed automatically when the hob contacts the blank. *They can be stopped instantly.* Operators have *confidence* in Elmes presses—and that's important, for it encourages exactness, cuts rejects, saves time *and money.*

HYDRAULIC PRESSES FOR EVERY PURPOSE

Whatever your pressing problem, check with Elmes. Objective engineering, backed by *nearly a century* of successful hydraulic experience, makes Elmes presses *right* for each job—for *cutting costs* on long runs or short—for *earning profits.* Write for literature.

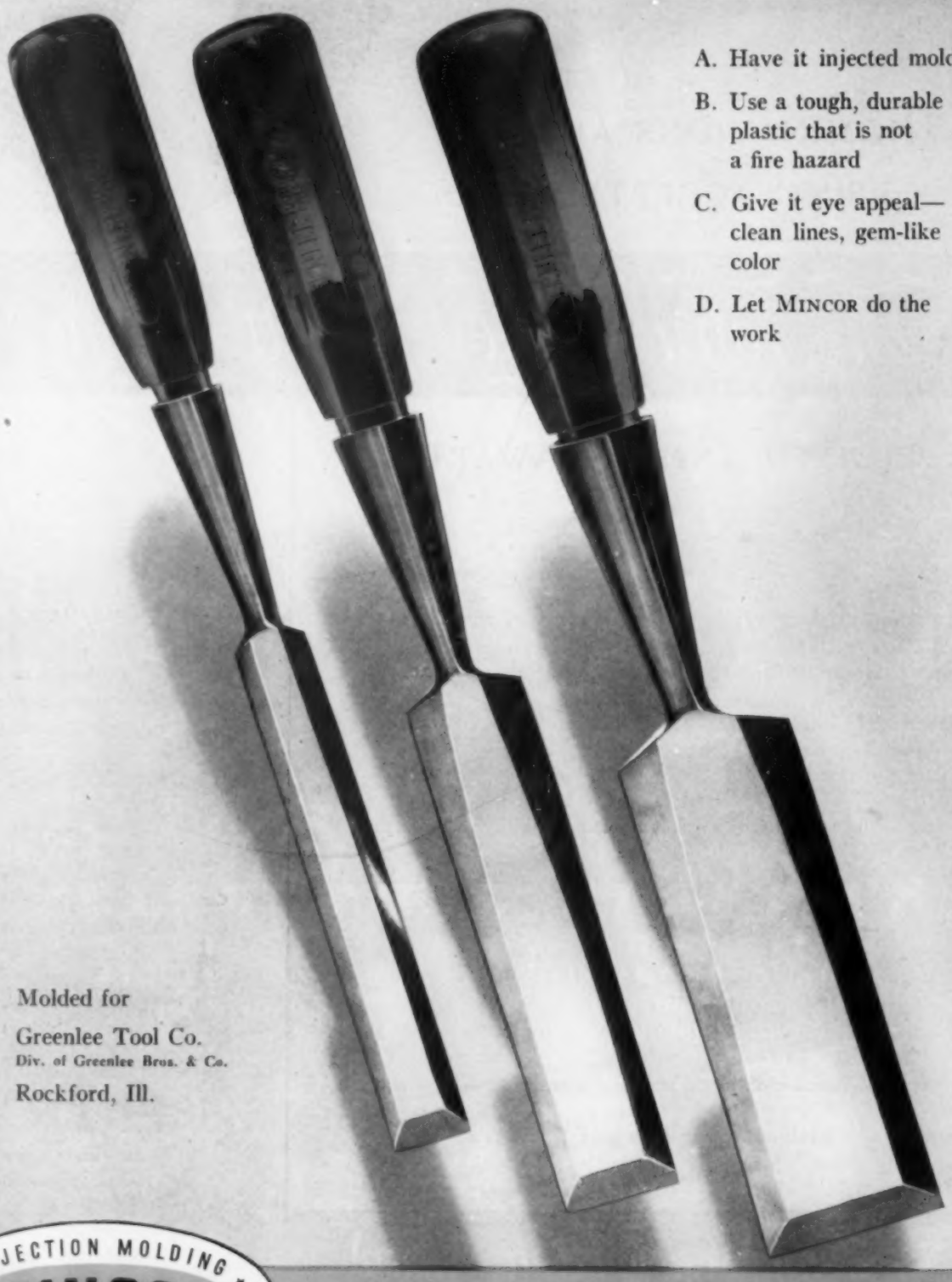
ENGINEERED BY ELMES
Good Hydraulic Production Equipment Since 1851

1500-ton Elmes hobbing press at Reinhold-Geiger, Los Angeles.

ELMES ENGINEERING WORKS *of* AMERICAN STEEL FOUNDRIES, 225 N. Morgan St., Chicago 7, Ill.
Distributors in Principal Industrial Centers • Also Manufactured in Canada

METAL-WORKING PRESSES · PLASTIC-MOLDING PRESSES · EXTRUSION PRESSES · PUMPS · ACCUMULATORS · VALVES · ACCESSORIES

The Proper Way to HANDLE a Chisel!



A. Have it injected molded

B. Use a tough, durable plastic that is not a fire hazard

C. Give it eye appeal—clean lines, gem-like color

D. Let MINCOR do the work

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MINCOR
"YOUR PLASTICS DEPARTMENT"

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The John Wesley Hyatt Award

EIGHTH ANNUAL AWARD

THE John Wesley Hyatt Award is presented annually to an individual for outstanding achievement of wide importance contributing to the advancement of the plastics industry. The Award consists of a gold medal and $1,000.

Any person connected with the plastics industry is eligible — whether he or she be a chemist, laboratory technician, toolmaker, molder, executive or engaged in any other capacity. No entry fee is required. There is no limit to the number of entries which may be submitted.

Statements of qualification (Entry Blanks) are in the mail to the industry. Additional entry blanks may be obtained from the Committee Secretary, 295 Madison Avenue, New York 17, N. Y.

The John Wesley Hyatt Award

Secretary to the Committee
WILLIAM T. CRUSE, 295 Madison Avenue, New York 17, N. Y.

PREVIOUS MEDALISTS

1941 — DR. DONALD S. FREDERICK
Rohm & Haas Company
Philadelphia, Pennsylvania

1942 — MR. FRANK SHAW
Shaw Insulator Company
Irvington, New Jersey

1943 — DR. STUART D. DOUGLAS
Carbide and Carbon Chemicals Corporation
South Charleston, West Virginia

1944 — MR. WILLIAM ILER BEACH
North American Aviation, Inc.
Inglewood, California

1945 — MR. VERGIL MEHARG
Bakelite Corporation
Bound Brook, New Jersey
MR. PAUL D. ZOTTU
Newton, Massachusetts

1946 — DR. JOHN J. GREBE
Dow Chemical Company
Midland, Michigan

1947 — JOHN D. COCHRANE, JR.
Formica Insulation Company
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- Finishing, Spraying, Painting and Bright Silvering

All Thermoplastic Materials

Here's Your Pilot Plant for Extruding Plastics

The new, improved 1" NRM Bench Model extruder is specifically designed for laboratory operation. The unit provides an ideal method of making small quantity runs. Because its operating characteristics are so similar to standard NRM production extruders, it can well serve as a pilot plant.

Most of the new improvements that have been incorporated in the present line of NRM extruders, have been included in the improved bench model.

The unit is equipped with cartridge heaters for electric heating and will handle all thermoplastics up to 800°F extruding temperature. It is also available with a jacketed cylinder for steam heating.

Hundreds of firms are successfully using this little unit. Write today for complete specifications and operating data.

CHECK THESE IMPROVEMENTS

Xaloy-306 cylinder liner for greater wear and corrosion resistance.
Surface hardened screw flight lands for close tolerance production.
Equipped with either Chromalox thermostat or pyrometer type heat controls.
Electrically heated combination tubing die and wire insulating head, optional.
Screw speeds, 20 to 56 RPM, and 45 to 126 RPM.
Capacity 6 to 8 lbs. per hour depending on section size and type of material.

NRM

NATIONAL RUBBER MACHINERY CO.
General Offices: AKRON 8, OHIO

Plastics MACHINERY DIVISION

EXPORT DISTRIBUTORS: OMNI PRODUCTS CORPORATION, 460 FOURTH AVE., NEW YORK 16, N. Y

VARCUM 3754
for
ROCK WOOL BINDER

A water soluble liquid resin recommended for use in making a binder for resilient rock wool batts.

Specifications:

Solids (ASTM)	68-72%
Specific gravity	1.20-1.25
pH	7.3-7.8
Viscosity at 25° C.	100-200 centipoises
Water tolerance	Over 800%
Free formaldehyde	Less than 4%

Solubility:

Soluble in methanol and ethanol. Limited solubility in other lower alcohols, in esters, ketones and water.

Varcum 3330 is also available for the same application, but Varcum 3754 is a new resin developed to be sold at a slightly reduced price.

Write for test size samples of these resins on your company stationery.

Synthetic VARCUM Resins

VARCUM CHEMICAL Corporation

NIAGARA FALLS, N. Y.

WHAT PROPERTIES

NITE-GARD
NURSERY LIGHT

Color, translucence and low cost made Koppers Polystyrene 3 a good choice for this night light molded by All Plastics Corporation, Avon-by-the-sea, New Jersey.

EMERSON PORTABLE RADIO CABINET

molded from Koppers Polystyrene. Superior molding properties of Koppers Polystyrene result in more perfect cabinets per day and lower costs. Molded by Worcester Molded Plastics, Worcester, Mass.

EXTRUDED FLUTED TUBE

of Koppers Polystyrene 8 for use in a decorative lamp. Heat resistance, crystal clarity and reflective properties were the qualities desired by the manufacturer, Plastex Corporation, Columbus, Ohio.

FRIGIDAIRE LIGHT DEFLECTOR

for the inside of a refrigerator. Koppers Polystyrene was chosen for its transparency, light diffusion properties and low water absorption. Molded by Wolverine Plastics for Michigan Molded Plastics.

DO YOU NEED IN A PLASTIC?

HEAT RESISTANCE? TRANSPARENCY? COLOR?

LOW MOISTURE ABSORPTION? EASY MOLDING? LOW COST?

Koppers Polystyrene

HAS THEM ALL

Newest in the line of Koppers Plastics is *Heat Resisting Polystyrene 8*. This plastic will come through the scalding water of the automatic home dishwashing machine and retain its shape. *It is the only polystyrene that sells at the same low cost of regular polystyrene and still has the heat resistance to withstand scalding water.* No longer do you need to pay a premium price for heat resistance.

Koppers Polystyrene 8 has all the superior polystyrene advantages—crystal clarity, limitless colors, excellent electrical characteristics, negligible water absorption and low cost—and it will stand temperature 30° higher than regular polystyrene. It can be used for plastic kitchenware, tumblers, and electrical appliances. It will stand the concentrated heat of a radio power tube and finds many applications in decorative lamps and plastic wall tile.

Where easy moldability is all important, Koppers Lubricated Polystyrene 3 offers the same low production costs and can be used for a tremendous variety of toys, display boxes and other items requiring mass production methods.

All of Koppers Polystyrenes sell at the same low price. Their light weight results in more pieces per pound. All scrap can be ground up and used again keeping production costs at a minimum.

Koppers new and different commercial process for making polystyrene results in a product of high purity with the same physical characteristics maintained order after order. Send the coupon for new booklet.

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Please send me your new booklet on Koppers plastics.

Name..... Position.....

Company.....

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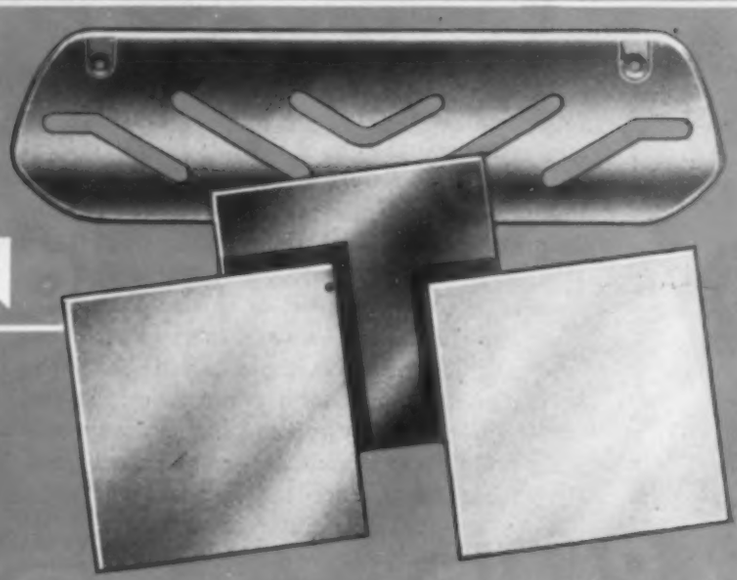
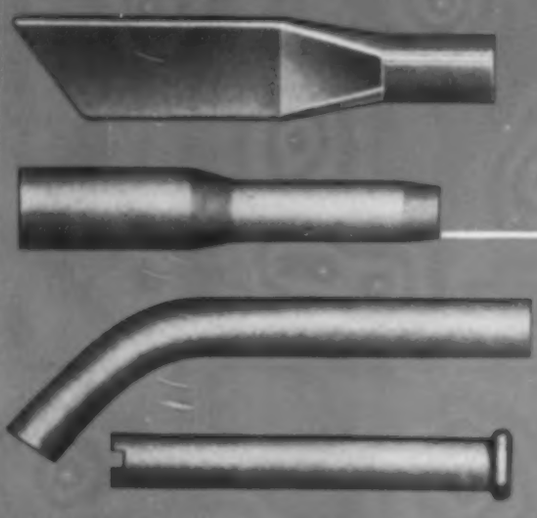
Koppers Plastics

•POLYSTYRENE •CELLULOSE ACETATE •ETHYL CELLULOSE

EXTRUSION



INJECTION



FABRICATION

Yardley "Tru-size" tubing is continuously molded in any wall thickness and size up to 2" O.D. High precision and absolute uniformity guaranteed. Many sizes carried in stock. Industrial gaskets, flat and pattern beltings extruded to your specifications.

Injection molding capacity up to 16 oz. We shape, curve, swedge and perform many other fabrication operations to make your plastic parts ready to use.

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YARDLEY PLASTICS CO.

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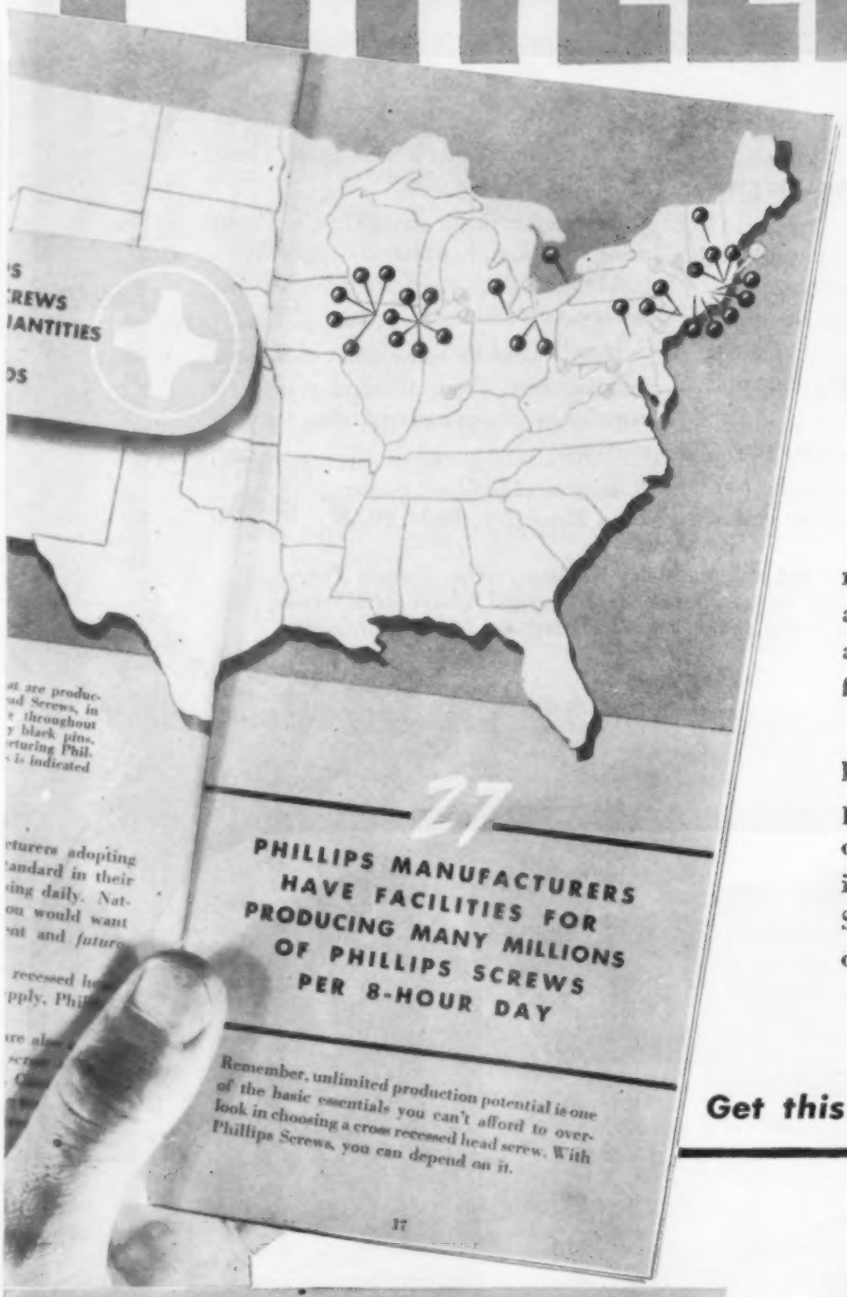
ONLY PHILLIPS RECESSED HEAD SCREWS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PHILLIPS MANUFACTURERS HAVE FACILITIES FOR PRODUCING MANY MILLIONS OF PHILLIPS SCREWS PER 8-HOUR DAY
Remember, unlimited production potential is one of the basic essentials you can't afford to overlook in choosing a cross recessed head screw. With Phillips Screws, you can depend on it.
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are available from MULTIPLE sources of supply

With the cross recessed head screw rapidly becoming the preferred screw for all types of industrial assemblies, it is all-important to be sure that present and future needs can be supplied.

Since Phillips is the only cross recessed head screw with *multiple* sources of supply, Phillips Screws are your logical choice. And this is just one of the five important reasons why *only* Phillips Screws give you *all* the advantages of the cross recess design.

Get this new Fact-Full Booklet

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GET ALL THE ADVANTAGES OF ASSEMBLY WITH CROSS RECESSED HEAD SCREWS . . .

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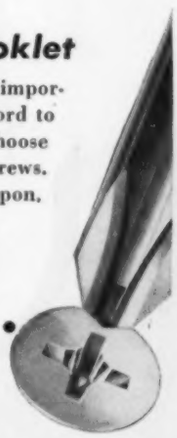

Phillips Screw Mfrs.,
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Send me the new booklet—"How to Select Recessed Head Screws for Practical Production Driving".

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Company _____

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MP-37

ASK STOKES

70% Labor Saving with Automatic Molding

Savings of 70% in labor costs were made by a custom molder when he used a Stokes completely automatic plastics molding press.

Previously he had used a conventional semi-automatic press with preformer and preheater. He produced the souvenir ash tray (illustrated) on a two-cavity mold at a total labor cost of $17.00 per thousand finished pieces.

Now, using a Stokes automatic 50-ton press, with a single cavity mold, he produces the same ash tray for a labor cost of $5.10 per thousand pieces . . . a saving of $11.90 per thousand for labor alone. These are his figures, *not ours.*

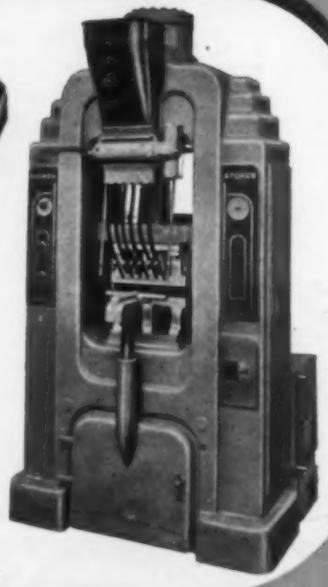
And further major savings resulted from using the high-production single-cavity mold, instead of the former higher-cost multi-cavity mold.

If you want to know what automatic molding can save you, send your own samples or blueprints to Stokes for free analysis.

F. J. Stokes Machine Company,
5934 Tabor Rd., Phila. 20, Pa.

Stokes makes Semi-Automatic and Automatic Molding Presses, Plunger Presses, Closure Presses, Preforming Presses, Industrial Tabletting and Powder Metal Presses, Vacuum and Special Processing equipment, Water Stills and Special Machinery.

This souvenir ash tray was produced at a 70% saving in labor cost on a Stokes Automatic Molding Press, similar to Model 235A, illustrated here.



Condensed Press Specifications, Model 235A

Maximum Press Capacity (Tons) . . .	50
Maximum Stroke (Inches)	14
Upper and Lower Platens (Inches) .	14 x 7
Feeding Device – Chambers	6
Capacity per feeding chamber, (Cu. In.)	⅛ min. - 4 max.

STOKES KNOWS HOW

ASK STOKES

If 1/6 of a man can make 7000 closures per hour...

. . . how many closures, etc.? Well, it runs into many thousands if you use a *whole* man and let him operate through a full day on a battery of Stokes Automatic Closure Presses.

All he has to do is fill the hoppers and take away the molded closures.

The Stokes Closure Press automatically unthreads threaded closures and delivers molded caps of uniformly high quality and correct density without shorts, checking, or discoloration.

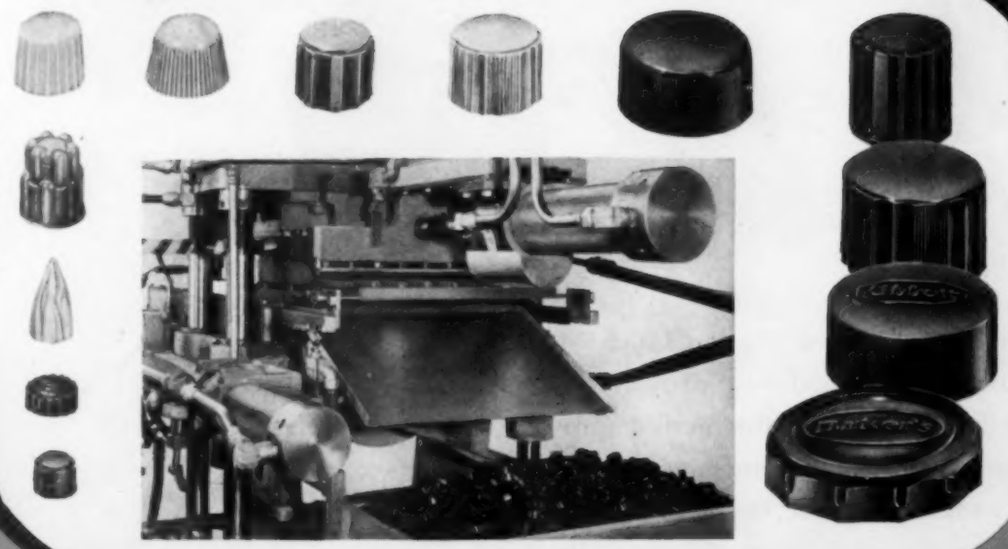
Change-over is simple when it is necessary to use different molds. You can make closures of many designs and sizes with internal or external threads.

Stokes make a *complete* line of automatic and semi-automatic plastic molding presses, but the automatic Closure Presses (in 2 models of different capacities) are designed specifically for the making of closures.

F. J. Stokes Machine Co.
5934 Tabor Road, Philadelphia 20, Pennsylvania.

FJS

Stokes makes Semi-Automatic and Automatic Molding Presses, Plunger Presses, Closure Presses, Preforming Presses, Industrial Tabletting and Powder Metal Presses, Vacuum and Special Processing equipment, Water Stills and Special Machinery.



Delivery end of Stokes Automatic Closure Press, and typical closures produced.

STOKES KNOWS HOW

The new Underwood Rhythm Touch
De Luxe is the embodiment of secretarial speed
and efficiency. Among the many improved features
of this modern writing machine are the cylinder knobs
with deeper threaded finger grip, and the variable line spacer
designed to permit easier, accurate aligning.
These plastic parts, incorporating metal inserts, are precision
molded for Underwood by Plastic Manufacturers.

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If there is a chance that your product is going to end up in a photo finish, select the plastic which has what it takes . . . and that means a Nixon Cellulosic Plastic. A product molded or fabricated from a Nixon Cellulosic Plastic is usually a length ahead in the race for sales. For your next molding or fabricating job consider using a Nixon Cellulosic Plastic. You will find it practical and economical to use, easily shaped or fabricated. Nixon C/N (Cellulose Nitrate), available in sheets, rods, and tubes . . . Nixon C/A (Cellulose Acetate) and Nixon E/C (Ethyl Cellulose), available in sheets, rods, tubes, and molding powder.

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Guidance is the first of many complete services we offer in satisfying your plastic needs. Selection of the proper plastic materials is of primary importance in the production of your product. For plastics . . . think of Bridgeport.

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Laboratory Mills furnished with built-in motor, control and adjustable speed drive. Entirely enclosed gears to operate. Mechanism is readily accessible.
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42—ton Laboratory Presses, entirely self-contained, equipped with 12"x12" platens, occupying floor space of only 14"x26". Has adjustable opening.
Presses for compression, transfer molding, laminating, and polishing. All sizes and types. Custom built.

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Midland, Michigan

Specialists in Custom Molding. Complete service in designing of molds—drafting, engineering, merchandising. Hundreds of stock items. Cigarette Items, Cases, Accessories, Flatware, Sporting Goods, Games, Refrigerator Articles, Toys, Cosmetic Items, Boxes, Containers, Dispensers, Kitchen-ware. We have the KNOW-HOW that produces beautiful boxes in clear plastics for the food and drug trade—boxes that give the impression your container is made of crystal-clear glass.

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(Subsid.)

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Custom molders by EXTRUSION of Saran, Ethyl Cellulose, Cellulose Acetate Butyrate, Polyethylene, Plexiglass, Lucite, Polystyrene, Styralloy, Vinyls. Suitable for pipe, tubing, tapes, strips, filaments, rattan, textile fabrics, screen, extruded shapes, trim, etc. Complete FABRICATION dept. makes it possible to carry IN STOCK thousands of items—including Black Pipe, Pipe Fittings, all sizes ⅛ to 3"; also Welded Pipe, Nipples, Elbows, Unions, Fittings of all kinds and tubing, 1/16 to 1". Above materials also molded by INJECTION into an endless list of plastic mdse. items and accessories. Our engineering dept. welcomes inquiries on your specific plastic problem.

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SELECTIVE CUSTOM MOLDING.

PLASTONE — MOLDING MATERIALS — We are licensed exclusively by the University of Tennessee for the manufacture and sale of these thermosetting molding powders employing cottonseed hulls.

INDUSTRIAL RESINS — Phenolic Resin Syrups for mineral wool insulation, adhesives, coatings, and ceramic binders.

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our research Dr. Fritz Rosenthal, formerly in charge of research at the University of Tennesse, and previously associated with RCA and the General Electric Co. is Director of Research and Development. Chris Van Deventer III heads our Industrial Engineering Department. Ira Valentine is sales Engineer and Technician to the original equipment manufacturers. Russell R. Bradshaw, for many years connected with Dow Chemical Company, Midland, Michigan, is in charge of our Injection Molding Divisions. These men are known for the contributions they have made in the growing Plastic Industry. Pass your trouble on to these men—whether your problem be molding, designing, engineering, technical advice, or research on materials in Plastics and Resin Applications.

ASSOCIATED PLASTIC COMPANIES, INC.

General Offices, 1198 Merchandise Mart Plaza, Chicago 54, Ill.

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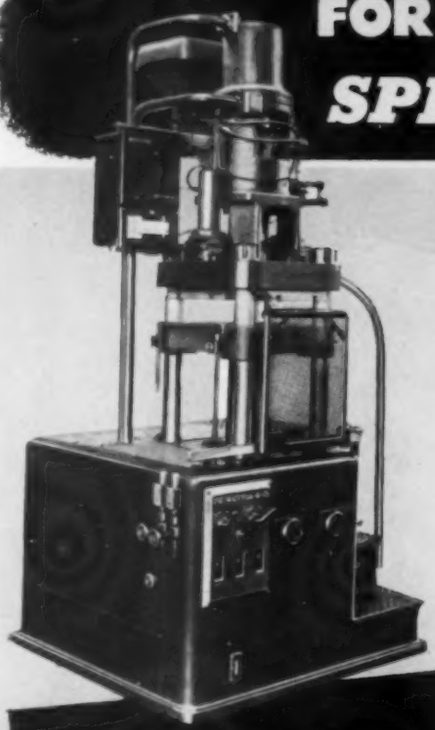
FOR IMPROVED PRODUCTION *SPECIFY* DE MATTIA



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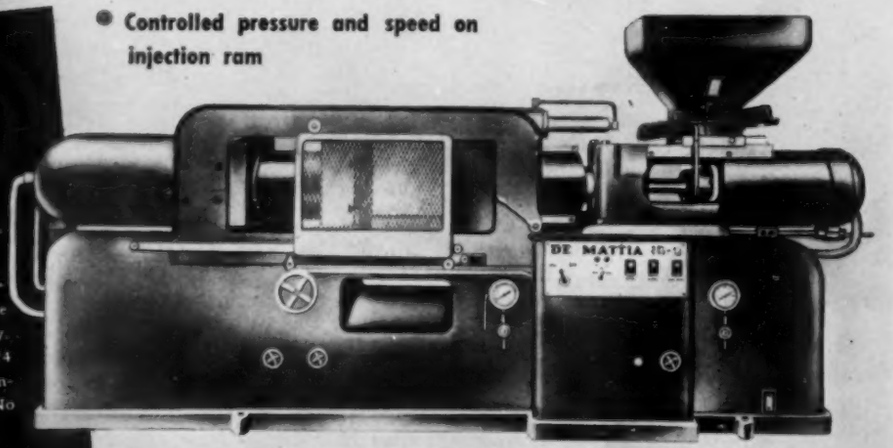
- **Solid steel frames for maximum strength and rigidity**
- **Straight hydraulic clamp pressure of over 400 tons employing a standard 1000 PSI hydraulic system**
- **Hardened and ground platen guides with gibs to take up for wear without dismantling**
- **Push button control for forward and reverse motion of injection ram**
- **Controlled snubber action on both movements of closing platen helps protect mold faces and also adjusts speed of ejector movement**
- **Mold opening can be set to minimum required for fast molding cycles**
- **Controlled pressure and speed on injection ram**

HYDRAULIC VERTICAL PRESSES—Recommended for general molding production and highly efficient on metal insert work. Available in 4 ounce or 12 ounce capacity. Illustrated literature, including specifications, sent on request.

ALL HYDRAULIC HORIZONTAL PRESSES—These ruggedly built presses feature every advantage known to the industry. Models are available with 6, 12 or 24 ounce capacity. Write for complete engineering data and specifications. No obligation.



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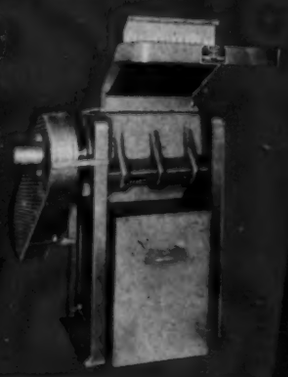
HIGH CAPACITY GRANULATORS

For LARGE SLUGS AND CHUNKS. The DeMATTIA CHUNK CUTTER provides low cost salvage of molded pieces too tough for ordinary scrap grinders. Capacity over 150 lbs. per hour.



FOR GRANULATING of sprues, runners and all kinds of thermoplastics. Handles 200 lbs. per hour. Can be hand-wiped in 3 minutes for color change.

Complete service on *MOLD MAKING*

Our mold department is equipped to handle your mold requirements, large or small, from start to finish including design and engineering service. Inquiries on mold making will receive prompt, courteous attention.

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Inside story on the outside of a picture

Television by RCA Victor means entertainment for the millions—but this lower priced, high-quality RCA Victor television set also provides serious food for thought for manufacturers of many other products.
The bezel framing the 10" kinescope, RCA Victor stylists said, should be metal. "Nope," said Engineering, "metal bezels that big have a tendency to pick up electrical disturbances in some areas. Won't meet RCA Victor standards!" "Nope," said Costs, "a complex metal shape that size runs up cost out of proportion!"
"Well, then—metallic appearance," conceded Styling.
So, on the basis of better properties and lower costs, we're plunger-moulding the bezel of plastics. *Heat-resistant* phenolic. Heat-resistant, because big as it is—thin-sectioned as it is—it withstands 1 hour of 250°F. without distortion while a gold enamel finish is baked in. It's tapped, ready to mount, with a minimum of warp, by only 4 corner bosses—to meet RCA Victor's exacting standards.

Kurz-Kasch

FOR OVER 33 YEARS PLANNERS AND MOULDERS IN PLASTICS

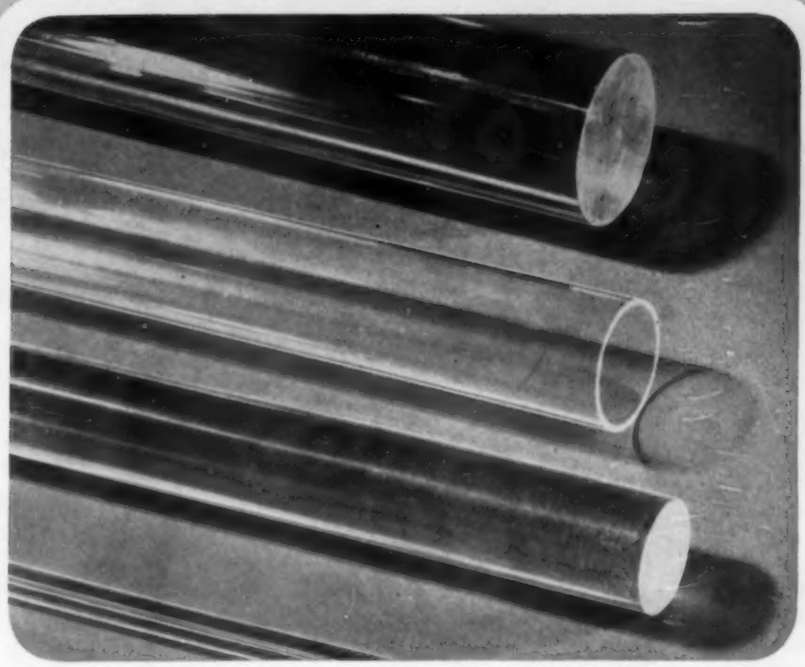
Kurz-Kasch, Inc. • 1415 South Broadway • Dayton 1, Ohio

BRANCH SALES OFFICES: New York, *Lexington 2-6677* Chicago, *Harrison 5473* • Detroit, *Randolph 5214* Los Angeles, *Prospect 7503* • Dallas, *Lakeside 1022* St. Louis, *Rosedale 3542* • Toronto, Canada, *Adelaide 1377.*

EXPORT OFFICES: 89 Broad Street, New York City, *Bowling Green 9-7751.*

In meeting RCA Victor's specifications on this job, we're justifying again the Kurz-Kasch reputation for superior moulding. Whatever your problems—if they call for imagination in compression, transfer or plunger techniques—we've got the men, the plant, the equipment, and the record of accomplishment. We're ready to tackle the complete job—to handle long runs—to set up and meet early delivery schedules—and we've been doing it since pioneering began in Plastics. May we send an engineer to talk things over?

A "JEWEL" OF A PLASTIC



You can say that convincingly about Methacrylate from Plax — literally, too. Its unblemished crystal clearness makes it a top material for costume jewelry — fountain pen stocks — furniture — and many other products where jewel-like eye appeal is desired. It is also a scintillating display material.

On the industrial level, excellent optical and other characteristics have prompted its use in sight gauges, in chemical pipe and equipment. A versatile plastic, easily heat-formed into many different shapes, Methacrylate is a material well worth investigation — and Plax is probably the best source of help you can find.

CHART ON "HOW TO USE PLASTICS"

Now available for the asking is a table of properties for six materials available from Plax in various forms and formulae. This has been incorporated in the Plax catalog, which also contains helpful information on the primary uses of each material.

A copy will be sent promptly upon receipt of your request.

Between the resources of Shaw Insulator Company, Irvington 11, N. J., and Plax Corporation, Hartford 5, Conn., you can find help on virtually every material and method in plastics today.

PLAX
FOR PLASTICS
NOT SUBSTITUTES···IMPROVEMENTS

P. O. BOX 1019 ★ HARTFORD 1, CONNECTICUT
In Canada — Canadian Industries, Ltd., Montreal

UNION PACIFIC

The Governor of Nevada *invites You*

STATE OF NEVADA
EXECUTIVE CHAMBER
CARSON CITY

VAIL PITTMAN
Governor

To American Industry:

With the rapid increase in population of the United States, combined with the decentralization of industry and the westward movement, Nevada is destined for great industrial expansion in the near future.

Contributing factors are:

1. Cheap hydro-electric energy
2. Raw materials, with emphasis on live-stock and minerals (metallic and non-metallic)
3. Other natural resources
4. Favorable labor conditions because of friendly relationships between industry, management and labor
5. Ideal climate and exceptionally favorable working conditions
6. Nevada's tax structure:
   - No Inheritance Tax
   - No Income Tax
   - No Sales Tax
   - No Tax on Intangibles
7. Unsurpassed transportation facilities and close proximity to water transportation.

I respectfully suggest that you investigate the opportunities and advantages Nevada offers industry for investment and expansion.

Cordially yours,

Governor

Vail Pittman

* One of a series of advertisements based on industrial opportunities in the states served by Union Pacific Railroad.

Unite with Union Pacific in selecting sites and seeking new markets in California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, Oregon, Utah, Washington, Wyoming.

***Address Industrial Department, Union Pacific Railroad**
Omaha 2, Nebraska

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Road of the Daily Streamliners

putting PLYON* ON ICE!....

Orchestra stand and set pieces made of PLYON.

PLYON plays a dozen important roles in the current ICE FOLLIES OF 1949, the original traveling ice extravaganza that will be seen by three million people in 18 cities from coast to coast.

The Shipstads and Johnson, producers and originators of the ice show idea, have selected PLYON above all other materials for the third successive season because:

1. PLYON IS DURABLE—withstands the most rugged treatment—tough enough to take the terrific impact of high speed steel skates.
2. PLYON RESISTS MOISTURE—while excessive dampness in ice arenas rapidly breaks down other materials, PLYON stands up without deterioration.
3. PLYON IS LIGHT—the ICE FOLLIES' many changes of scene require settings and set-pieces of extreme light weight. Featherweight PLYON is perfect for this purpose, as well as for economy of shipment.
4. PLYON HAS BEAUTY—it can be moulded into endless graceful forms, takes color perfectly, either by dyeing or painting, and is translucent to light.

Jar, gateway and other "props" made of PLYON.

"Bang board" around rink made of PLYON

***PLYON** *is obtainable in various resin formulations and filler constructions which may consist of Nylon, Fiberglas, Cotton and Paper, singly or in combination.*

Call or write us your requirements. We'll be glad to help you solve your problems with PLYON or FABRICATED ACRYLICS. (The sets and properties for the Ice Follies were fabricated of PLYON by the Studio Prop Shop, Burbank, Calif.)

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PLASTICS CO.

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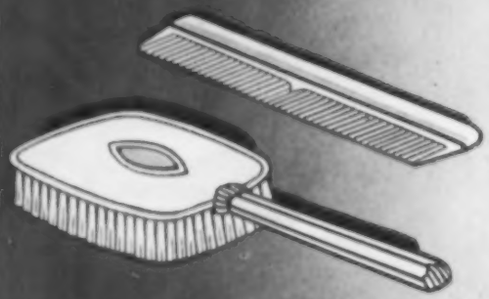
Leaders and pioneers in laminated plastics and ACRYLIC fabrication

FOR THE GREATEST

WHITENESS • BRIGHTNESS • OPACITY

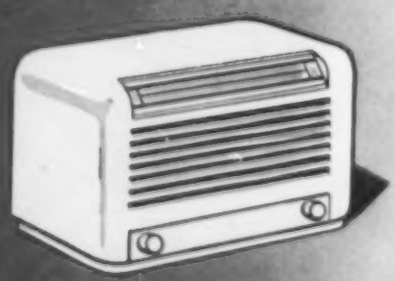
IN PLASTICS . . .

. . . USE



TITANOX

PIGMENTS



● Plastic compounders know from experience that these titanium dioxide products are the strongest among white pigments in brightening, whitening, tinting and opacifying power. Desired results are achieved with minimum loading, thus contributing to flexibility and economy. TITANOX pigments also possess excellent physical and chemical stability. You may have complete opacity or you may control the degree of translucency as required.

TITANOX pigments are available in rutile types to assure the most effective application in plastics. In vinyl sheeting, for example, they are preferred because of their maximum opacifying power as well as improved sunlight resistance.

Our Technical Service Laboratory staff will be glad to furnish additional data or help you choose the proper grade of TITANOX for your products. Telephone or write our nearest office. Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; 104 So. Michigan Ave., Chicago 3, Ill.; 2600 So. Eastern Ave., Los Angeles 22, Cal. Branches in all other principal cities.

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Subsidiary of NATIONAL LEAD COMPANY

Auten Ready Case molded for Auten Manufacturing Co., Princeville, Illinois

A Case of Convenience

We enjoy working with new ideas. They present a stimulating challenge to our engineering and molding skill. For example, take this Auten Ready Case, an idea typifying GI ingenuity. Its inventor, while stationed in the Philippines, conceived it as a way to conveniently handle matches, cigarettes and cigarette case at the same time. Our objective was to mold a case with sales-winning eye appeal that matched its increased functional appeal. To this end we applied our inflexible production formula—correct use of the right plastic material—skillful use of the most effective molding technique. Why not discuss your new product idea with us? If its production lends itself to our injection molding or extrusion technique we will assure you a product of peerless quality. Consult us without obligation.

Write on your letterhead for the new Injection Molded and Extruded Plastics Catalog. Or, for detailed information about MILLS PLASTIC® piping, tubing and fittings, write for circulars containing data and illustrations.

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ELMER E. MILLS CORPORATION

INJECTION MOLDERS and EXTRUDERS of: Tenite, Lumarith, Plastacele, Fibestos, Lucite, Plexiglas, Nylon, Polystyrene, Styron, Lustron, Loalin, Vinylite, Geon, Flexene, Polyethylene, Cerex, Forticel, MILLS PLASTIC®, Saran, and other Thermoplastic Materials

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MPc PLASTICS FURNISH

Pre-fabricated Housing

FOR RCA WIRE RECORDERS

Pre-fabricated, with all assembly holes and studs molded in, these housings fit neatly into a smooth-flowing assembly operation. The sleek, streamlined design provides ample strength to protect and support the wire recorder mechanism.

Tooled and molded at **MPc**, this housing shows again how plastics may be successfully employed to serve multiple purposes. Submit your plastics product or problem to MOLDED PRODUCTS CORPORATION, 4535 W. Harrison St., Chicago 24, Illinois.

PLASTICS MPc DIVISION

MOLDED PRODUCTS CORPORATION

COMPRESSION, INJECTION AND TRANSFER MOLDING

carbolac 2

to pigment polyethylene

supercarbovar

to pigment polyesters

These Cabot carbon blacks, used at one-half part loading, produce the blackest colors obtainable.

Carbolac 2 should be milled at loadings of twenty-five parts in polyethylene and reduced to one-half part.

Supercarbovar can be milled at one-half part loading.

GODFREY L. CABOT, INC.

77 FRANKLIN ST., BOSTON 10, MASS.

Goliath isn't HALF the man L'il Joe is !

WE'VE got a point to make . . . and we were afraid you might pass over this ad if we used a graph or a chart. So we cooked up Goliath and L'il Joe to do the job.

To begin with . . . *both* of these lads are sitting on "raw materials". L'il Joe is sitting on PLASTICS. He represents the amount of *labor* required to mold plastics. Altho you can see that he uses a lot of material (raw plastic), he molds thousands of duplicate pieces *from a single mold.* And there are very few finishing touches (extra man hours) needed to complete the job.

Next, take Goliath. *He* represents a *lot* of labor (man hours) needed to produce pieces from *other* raw materials. Sure . . . he doesn't use much raw material, and it *may* be cheaper . . . but think of all the extra drilling, tapping, filing, painting and machining of all sorts to produce your product!

NOW . . . notice that L'il Joe's height (including the BIG pile of raw plastic he's squatting on) does not come as high as Goliath's (including the LITTLE pile of other raw materials he's sitting on). CATCH?

Yep, you're right! They both represent the COST TO YOU of *combined* Labor-and-Materials that go into your finished product.

(P. S. We *think* the idea of putting Goliath and L'il Joe up there was a cute idea. But . . . maybe we *shoulda* used a graph instead. What do *YOU* think?)

Boonton

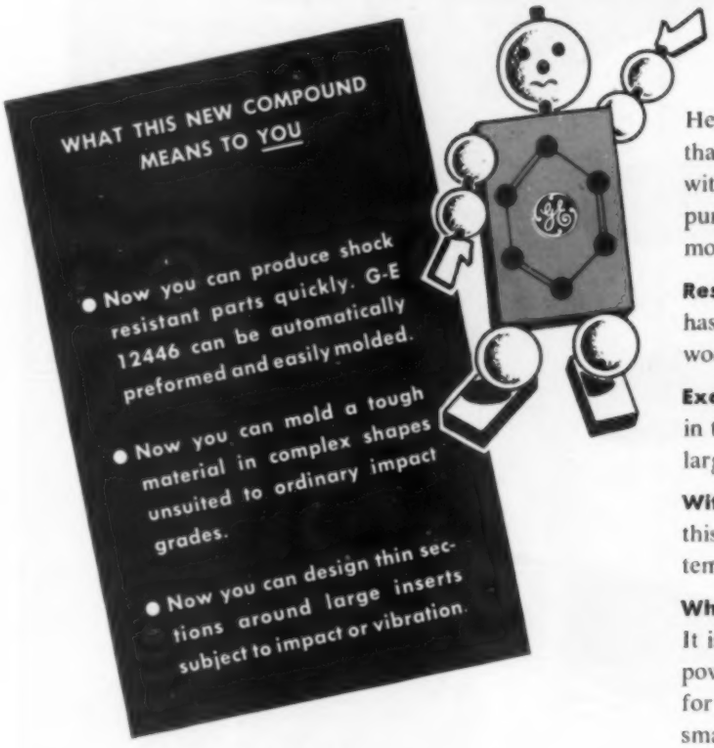
THE BOONTON MOLDING COMPANY

Boonton 3, N. J. Boonton 8-2020

MOLDERS OF MOST PLASTICS BY MOST METHODS

announcing

GENERAL ELECTRIC'S *New* HYCAR*-PHENOLIC MOLDING COMPOUND


WHAT THIS NEW COMPOUND MEANS TO YOU
● Now you can produce shock resistant parts quickly. G-E 12446 can be automatically preformed and easily molded.
● Now you can mold a tough material in complex shapes unsuited to ordinary impact grades.
● Now you can design thin sections around large inserts subject to impact or vibration.

*Hycar American rubber; registered trade name, B. F. Goodrich Chemical Company.

Here's a remarkable new G-E molding compound that combines the toughness of impact grade materials with preformability and moldability similar to general purpose phenolics! It's General Electric's 12446 molding powder, a Hycar*-phenolic compound.

Resists shock—impact tests show that 12446 has five times the endurance of general purpose wood-flour-filled phenolics.

Excellent Resilience—12446 can be safely molded in thin sections; it's ideal for parts with large inserts subject to vibration or flexing.

Withstands Thermal Shock—parts molded from this new material are unaffected by sudden temperature changes.

Where can you use this new molding powder? It is well suited for molding handles for knives, power tools, appliances and industrial equipment; for business machine keys and housings; for small transformer cases; instrument housings, and many other applications. FIND OUT MORE about 12446. For a detailed data sheet write: Section DX-1, Chemicals Division, Chemical Department, General Electric Co., Pittsfield, Mass.

You can put your confidence in

GENERAL ELECTRIC

CD49-AA1

L IS FOR LARGE PROJECTED AREA

The Lester "L" is often a symbol of the exceptional achievements of Lester Injection Molding Machines. To the Bert M. Morris Company of Los Angeles, the Lester "L" has meant the ability of the Lester machine to fill a cavity of LARGE projected area in molding their most recent product—a sectional letter tray.

The company informs us that they are running this polystyrene part, weighing 11 ounces, covering 95 square inches of flat area (which is within 5% of maximum molding area), and are using only 60% of the capacity pressure. For this large, complex part the molding cycle has been cut to only 43 seconds.

Over and over again, our customers supply us with such facts, which prove that Lester features are more than just specifications—they are the backbone of the injection molding machines which are consistently producing the finest molded plastics.

Write for your free copy of the Lester Press.

LESTER INJECTION MOLDING MACHINES

distributed by LESTER-PHOENIX, INC. • 2621 CHURCH AVENUE • CLEVELAND 12, OHIO

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The Hotchkiss
Staple Remover and Letter Opener.
A product of
The E. H. Hotchkiss Co.
Norwalk, Conn.
"Pioneers in All
That's Best in
Stapling"

if Good Workmen deserve Good Tools *then* Good Tools deserve Plastic Handles!

SPECIAL BULLETIN

Consolidated Announces Successful Development of New, Improved

COFFEE MAKER HANDLE

OUTSTANDING EXCLUSIVE FEATURES!

Double thumb rest atop handle arch permits perfectly balanced grasp by either right or left hand. Underside finger channels insure firm, steadied grip. Handle is molded of tough phenolic with heat-resistant, high-impact strength qualities. Designed as a carried-in-stock item. Low priced. Now available for industry's quantity requirements. Details upon request.

The Handle of this *Hotchkiss* Staple Remover and Letter Opener is being User-complimented!

Injection-molded by Consolidated of polystyrene, this simply designed, highly practical grip demonstrates the wisdom of good handling! It is proving very popular both as a carded retail item and premium device. The flat, high-polished handle area lends itself perfectly to imprinting.

Of prime importance is the fact that the customer—and his customers—are well pleased. We of Consolidated invite the opportunity to apply our know-how to any and all custom molding assignments—plunger, compression, injection. Our experienced sales engineers are at your service. Inquiries invited!

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"More than Paper"

To the plastics industry, MOSINEE stands for paper-base processing materials with scientifically controlled chemical and physical properties, quality and uniformity . . . high tensile and tear strength with high absorptive capacity.

Other technical characteristics are controlled to meet specific plastics production requirements.

MOSINEE PAPER MILLS COMPANY • MOSINEE, WIS.

"Essential Paper Manufacturers"

no fire hazard here.....

SANTICIZER 141

MONSANTO'S NEW FLAME-RETARDANT PLASTICIZER

By incorporating Santicizer 141 in polyvinyl chloride films you can achieve exceptional flame-retardant qualities without sacrificing flexibility or drape. This superiority is proved by a comparison of burning rates — Santicizer 141 flames out in *1 second flat*, while other equally efficient plasticizers have a minimum burning rate of 38 seconds.

In addition to this vital safety factor, Santicizer 141 has many other advantages as a plasticizer for vinyl compositions used in curtains, upholstery materials, tablecloths, floor tiling, wearing apparel and a wide variety of similar products:

Low toxicity • High compatibility with vinyl resins • Low volatility • Softness and drape • Resistance to weathering • Strength, elasticity, abrasion resistance • Good low-temperature flexibility.

Santicizer 141 is now available in commercial quantities. Send today for samples, application and technical data. MONSANTO CHEMICAL COMPANY, Desk A, Organic Chemicals Division, 1707 South Second Street, St. Louis 4, Missouri.

Santicizer: Reg. U. S. Pat. Off.

COMPARATIVE "FLAME-OUT" TIME

Santicizer 141 vs. two similar plasticizers

Santicizer 141 . . . 1 Second

MONSANTO CHEMICAL COMPANY
Desk A, Organic Chemicals Division
1707 South Second Street, St. Louis 4, Missouri
Please send me latest data on Santicizer 141 for_____

Name_____ Title_____
Company_____
Address_____
City_____ State_____

SERVING INDUSTRY . . . WHICH SERVES MANKIND

MONSANTO
CHEMICALS — PLASTICS

DURITE

- LOW ELECTRICAL LOSS
- MECHANICAL STRENGTH
- RESISTANCE TO HEAT
- PERMANENCE
- ECONOMY

Reasons why DURITE Phenolic Resins are utilized by Henry L. Crowley & Co. Inc. in bonding powdered iron to produce Magnetic Cores designed for maximum efficient service.

THE BORDEN COMPANY
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5000 SUMMERDALE AVE., PHILA. 24, PA.

mold thermosetting materials
on the

ROCKFORD HY-JECTOR

8 oz. and 16 oz.
Capacities

- to eliminate all intermediate handling
- to prevent losses from moisture absorption
- to control variables in powder

When you figure a job to the fraction-of-a-cent-per-finished-part, the ROCKFORD HY-JECTOR gives you three all-important advantages. Because the machine performs all steps in a production cycle from powder to finished part, in a fast, uninterrupted sequence . . . the costs resulting from the numerous handling steps in conventional molding practice are completely eliminated. With the ROCKFORD HY-JECTOR the *only* handling required is the initial loading of the powder into the hopper and the removal of the finished parts.

In addition, the ROCKFORD HY-JECTOR cycle eliminates the need for preform storage and thereby the losses from moisture absorption. And because no more than an average of four cycles are ever in process at one time, short or excess preforms due to powder variables are quickly detected at minimum waste of materials. For all the facts about the ROCKFORD HY-JECTOR for thermosetting materials . . . write for Bulletin 147.

ROCKFORD MACHINE TOOL CO.
ROCKFORD • ILLINOIS

ROCKFORD HY-JECTOR

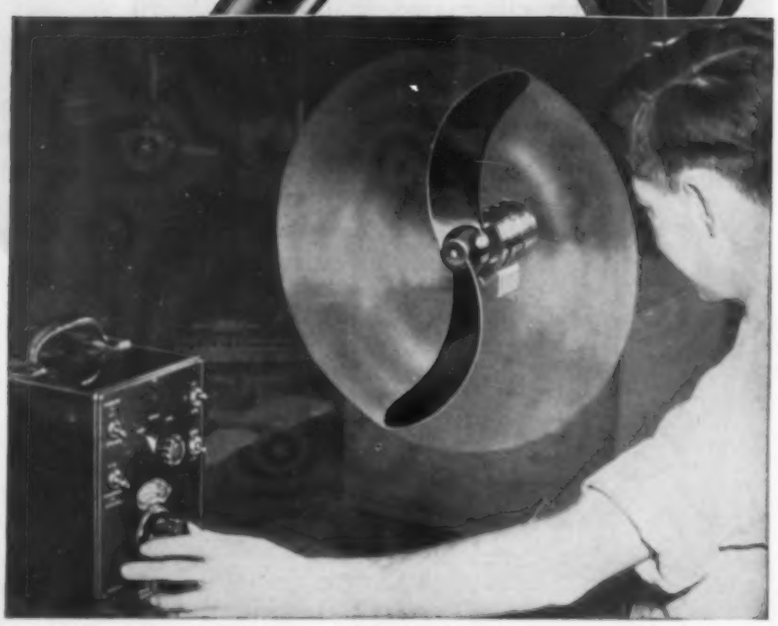
ANNOUNCING

COMPLETE *molding* SERVICE

A fully equipped custom molding department has been established to prove the advantages of the ROCKFORD HY-JECTOR method on a custom molding basis. We offer thermosetting moldings of superior quality at lower prices. Submit a sample or print for our bid. A Rockford engineer is available for consultation on that tough molding problem.

. . . close-tolerance production

FOR



Precise product quality control—from latest-type molding equipment to testing laboratory—insures uniformity, accuracy and dependability in all plastics products molded by General Industries.

Here's real evidence of the close-tolerance attention your plastice products receive when they are precision-molded by The General Industries Company.

These plastic fan blades—ranging in size from 18″ to 30″—are molded by General Industries for a leading midwest manufacturer of residential and commercial fans.

CLOSE-TOLERANCE PRODUCTS

To assure smooth, steady operation, at speeds up to 2000 rpm, absolute balance is an essential requirement in each blade. General Industries attains this absolute balance through precision molding—and does it on a mass production basis. Tolerances are held so closely that rejects are negligible. Production costs are down to a welcome low level—another example of The General Industries Company's ability to help manufacturers reduce costs with well-planned plastics.

With experience gained from more than 25 years of developing and improving plastics molding techniques, General Industries has a valuable fund of engineering knowledge ready to serve you. Write us *today.*

FOR THE *BEST* IN MOLDED PLASTICS

THE GENERAL INDUSTRIES CO.
MOLDED PLASTICS PIONEERS
DEPARTMENT R • ELYRIA, OHIO

INTERLAKE

Resineering

The Open Door to complete resin service

To meet the problems of their individual application, many resin users have profitably applied Interlake ***Resineering*** — *development of a resin to meet the specific requirements of each job.* This service consists of:

ANALYSIS of your requirements
DEVELOPMENT of a resin for your need
JOB TESTING this resin in *your* plant
CONTROLLED PRODUCTION for continuous uniform performance

Interlake ***Resineering*** gives definite benefits — improved quality of product, plus lower production costs due to fewer rejects. Yet resins produced by this service *cost no more.*

At Interlake the door is always open to your resin problems . . . to improve your present techniques or to develop new applications.

INTERLAKE CHEMICAL CORPORATION
Union Commerce Building • Cleveland 14, Ohio

BASIC APPLICATIONS OF INTERLAKE RESINS:

Bonding
Surfacing
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Impregnating

of such materials as cloth, paper, wood, cellulose waste and fibrous material.

INTERLAKE CHEMICAL
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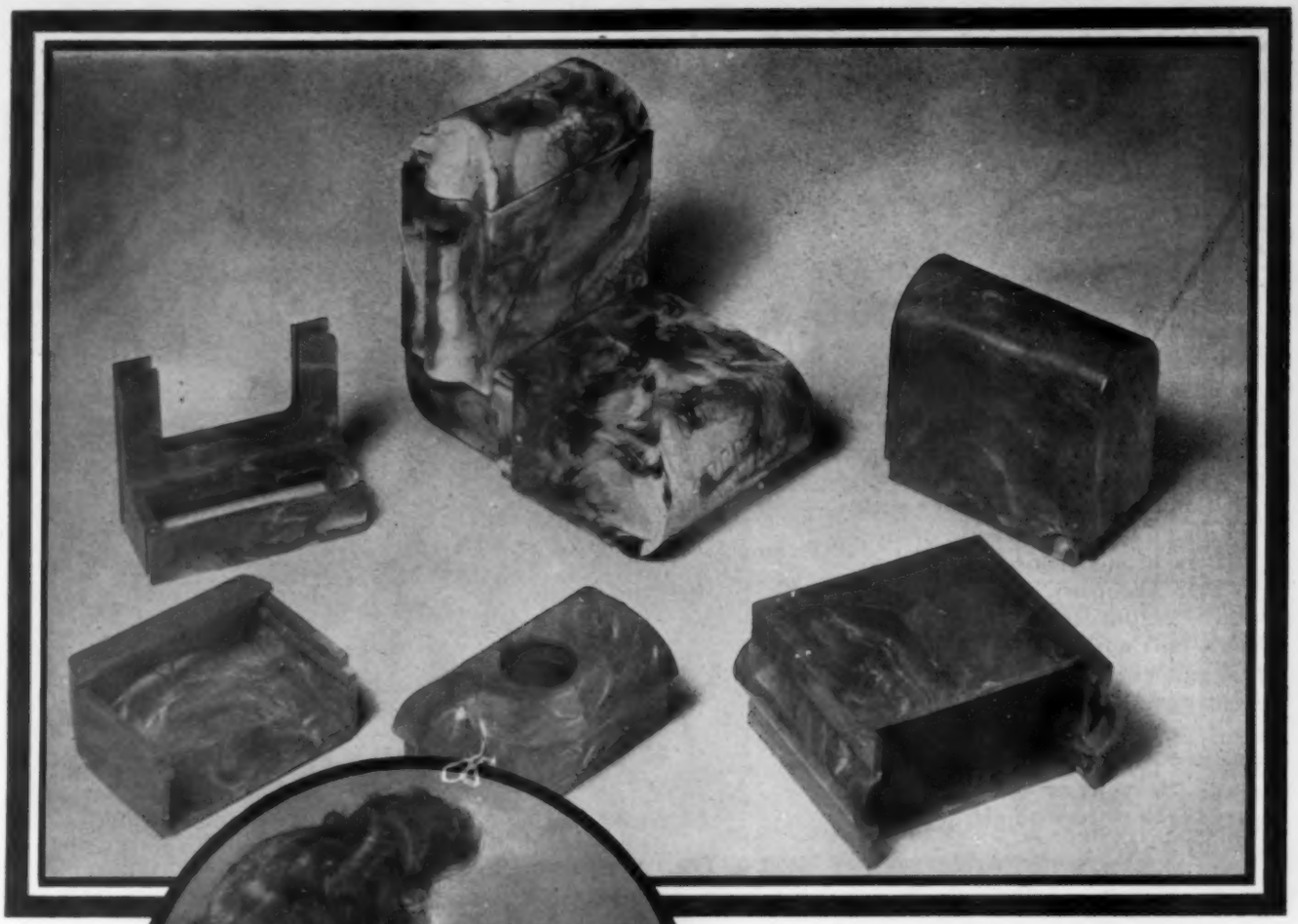
• PRODUCTS FROM COAL •



CREATIVE CUSTOM MOLDING

Illustrated above is the Arcadia Viewer, distributed by Arcadia Manufacturing Company of Chicago.

The product consists of small parts obtained from a family of five cavity die. The parts are injection molded in acetate in a variety of colors.

Cruver's designing and production engineers are ever ready to assist you in plastic molding problems.

CRUVER MFG. CO.

Est. 1896

MOLDING • FABRICATING • LAMINATING • FINISHING
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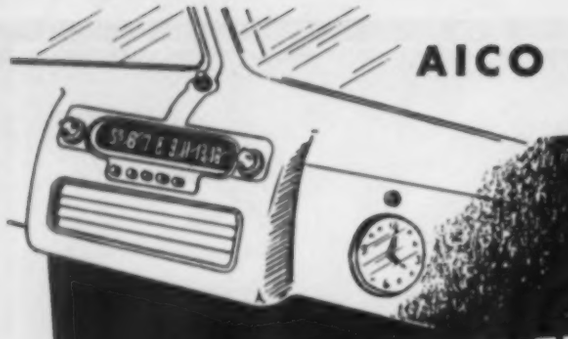
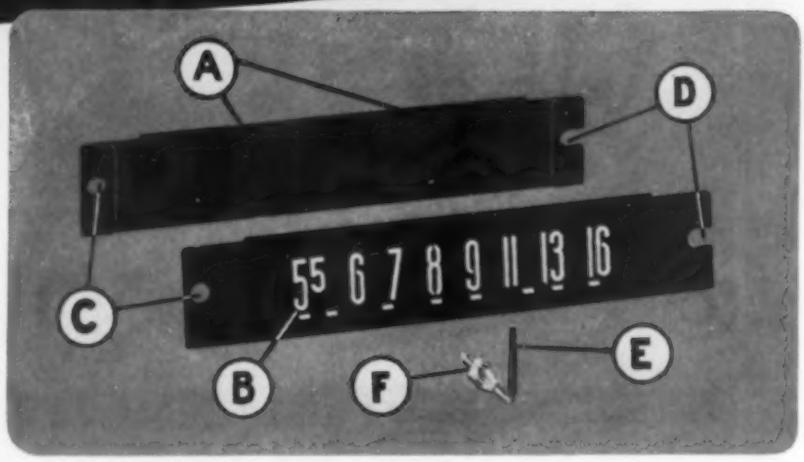


AICO MOLDED PLASTICS...

Bright Spot IN MANY WELL KNOWN PRODUCTS

Plastic parts for the backlighted dial of this high quality radio made by Bendix Radio Division of Bendix Aviation Corporation for Ford Motor Company, are molded by Aico. Skillful design, material selection and molding result in functional parts which are decorative and distinctive. Bendix is but one big name that comes to us with plans for new products. It's amazing how many successful products are highlighted with plastics molded by Aico.



The three parts of this backlighted dial are injection molded of methyl methacrylate, selected for its optical properties. At the top is the light filter through which the dial is evenly illuminated by two small bulbs placed behind the sand-blasted diffusion areas (A).

A four cavity mold has a capacity of 22,000 of these parts each week. The figures and graduations on the subdial (B) are molded *through* cut out areas in an anodized aluminum strip in a two cavity mold at a rate of 15,000 weekly. The only finishing operation on these two parts is simple gate removal. Holes (C) and slots (D) in the filter and dial register for rapid, fool-proof assembly. The crystal clear pointer comes from a ten cavity mold with a weekly capacity of 120,000. It "pipes" light from the same two bulbs that light the dial. The back of tip (E) is painted red and glows softly but distinctly against the green figures when in operation. Brightness of this glow is enhanced by painting the back surface of the light gathering prism (F) white to increase its internal surface reflection. Shields expose only the right portions of the pointer for speedy spray painting.

When you modernize your product or plan a new one, take advantage of Aico engineering service. Backed by more than 30 years of molding all materials by all methods, we are fully qualified to make unbiased recommendations for the best plastics applications for your needs.

AICO
PRECISION MOLDING
for over 32 years

We have prepared a Portfolio showing 28 of the many successful applications of Aico molded plastics. Write for your copy today.

AMERICAN INSULATOR CORPORATION
New Freedom, Pennsylvania

MANY THINGS ARE BETTER BECAUSE OF PLASTICS

MODERN PLASTICS

VOLUME 26 JANUARY, 1949 NUMBER 5

1948 . . . and the Future

FORECAST AND REVIEW

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PHENOLICS, with a 300,000,000 lb. total, again led the plastics industry in total consumption for 1948 but with a slight decline from 1947 as shown in Table I, page 56.

Vinyls of all types grouped into one classification showed a healthy increase of from 184,000,000 lb. in 1947 to 230,000,000 lb. in 1948. Polystyrene came along fast, particularly at the end of the year, to approach 150,000,000 lb., a 55% increase over 1947.

Growth of the entire plastics industry, clearly etched on the record by figures showing the consumption of raw materials by molders, extruders, fabricators, calenderers, and coaters, moved ahead by a little less than 10% in 1948 over 1947, according to the totals compiled in Table I. This figure, almost 1,000,000,000 lb., compares with a 15% advance in 1947 over 1946.

Synthetic resin production increased from 994,277,000 lb. in 1946 to 1,251,699,000 lb. in 1947, or over 25%, according to the Tariff Commission figures presented in Table VII on page 77. When the cellulosics are added, the total for 1947 of synthetic resins and cellulosics is approximately 1,334,899,000 lb., as shown in the bar chart on page 57. The 1948 Tariff Commission figures for synthetic resins are not yet available. The reader is cautioned to watch the year when making comparisons.

The difference in the 1947 figures in Tables I and VII is accounted for by the fact that Table VII includes a total of 453,000,000 lb. consisting of resins used for protective coatings, in addition to coumarone indene, and various miscellaneous resins not generally included in what has come to be known as the plastics industry. The protective coating volume, largely alkyd resins, was by far the largest single outlet for any one use classification in the synthetic resin industry. See Table VIII on page 78. It should also be pointed out that the Tariff Commission figures are based entirely on solid type resins, while many of the figures in Table I include filler such as that used in molding compounds.

It is regrettable that plastics statistics are so unsatisfactory. Rubber, steel, paint and lacquer, lumber, and many other industries collect complete and accurate statistics which are found valuable and helpful, but the plastics industry figures are as confusing as dollar exchange in China.

Furthermore, there are many items left out of plastics statistics that would add considerable poundage to the total. For example, movie, camera, and X-ray film, which use thousands of pounds of cellulose nitrate and cellulose acetate, are not included. In addition, the cellulose nitrate used for cloth or paper coating (pyroxylin) and in lacquers is not included in either set of figures referred to above. The vinyls are reported partially as compound and partially as solid resin; it would seem that total compound figures are needed to give a

Table I.—Manufacturers' Shipments and Consumption of Plastics and Synthetic Resins,[a] Exclusive of Protective Coatings, for Last Three Years in Pounds.

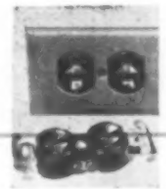
	1946	1947	1948[b]
Cellulose acetate and mixed ester plastics[c]			
Sheets			
Continuous (under 0.003 gage)	7,649,795	7,227,370	7,200,000
Continuous (0.003 gage and upward)	7,498,529	7,843,613	7,000,000
All other sheets, rods, and tubes	4,715,401	3,851,354	3,000,000
Molding and extrusion materials	83,204,045	58,524,134	48,000,000
TOTAL	103,067,770	77,446,471	65,200,000
Nitrocellulose plastics[c]			
Sheets	10,932,131	9,216,859	7,000,000
Rods and tubes	7,228,862	3,668,652	3,000,000
TOTAL	18,160,993	12,885,511	10,000,000
Other cellulose plastics[c, d]	12,183,113	3,500,000	8,000,000
Phenolic and other tar acid resins			
Laminating (dry basis)	27,725,337	40,546,186	41,000,000
Adhesives (dry basis)	16,120,513	21,069,109	22,000,000
Molding materials[c]	140,216,443	193,969,462	179,000,000
All other, including casting (dry)[c, e]	58,201,169	63,455,641	58,000,000
TOTAL	242,263,462	319,040,398	300,000,000
Urea and melamine resins			
Adhesives, (dry basis)	40,797,108	48,553,622	53,000,000
Textile and paper treating (dry basis)	13,534,368	15,948,902	18,500,000
All other, including laminating but exclusive of molding powder[c, f, g]	3,896,580	9,789,063	(Not available. Included in miscellaneous)
TOTAL	58,228,056	74,291,587	71,500,000
Polystyrene[c, e, g]	66,769,321	94,990,618	149,000,000
Vinyl resins			
Sheeting and film, including safety glass sheeting[c]	52,079,495	66,425,689	103,000,000
Textile and paper coating—resin content	11,673,212	17,235,802	33,044,877
Molding and extrusion—resin content	61,852,162	73,113,605	74,332,250
All other, including adhesives but exclusive of protective coatings[e]	27,082,895	27,062,369	20,865,530
TOTAL	152,687,764	183,837,465	231,242,657
Miscellaneous resins[j]			
Molding materials[c, h]	50,000,000	56,404,442	66,000,000
All other (dry basis)[e, i]	35,689,921	29,573,675	33,000,000
TOTAL	85,689,921	85,978,117	99,000,000
GRAND TOTAL	739,050,400	851,970,167	933,942,657

[a] Based on Bureau of Census, Dept. of Commerce reports.
[b] Last three months of 1948 estimated.
[c] Includes fillers, plasticizers, and extenders.
[d] Includes ethyl cellulose and related plastics.
[e] Excludes data for protective coating resins.
[f] Excludes urea and melamine molding materials; see footnote [h].
[g] Dry basis, including necessary coloring material.
[h] Includes data for urea and melamine, acrylic acid, and miscellaneous molding materials.
[i] Includes data for petroleum resins, acrylic acid ester resins, mixtures and miscellaneous synthetic materials.
[j] An estimated figure in 1946 for entire year due to overlapping and change in method of reporting.

true picture just as filled compounds are reported in molding powder. Laminates are in the same category. Poundage of treated sheets laminated together is just as important to help gain a clear picture of the plastics industry as is the amount of dry resin used in the laminating varnish.

In the rest of the pages of this issue devoted specifically to a review and forecast of the various aspects of the plastics industry, the facts and figures thus far briefly recorded are dealt with in more expanded detail. Attention is also invited to the Engineering and Technical Sections for comprehensive reviews of mechanical developments and of the current literature pertinent to the plastics industry.

Plastics Supply and Demand



PHENOLICS

A SHARP SLUMP HIT THE phenolic molding industry in the late Spring and Summer, with the result that molding powder consumption for the year dropped off from almost 200,000,000 lb. in 1947 to 180,000,000 lb. in 1948. All other phenolic classifications held about even with 1947.

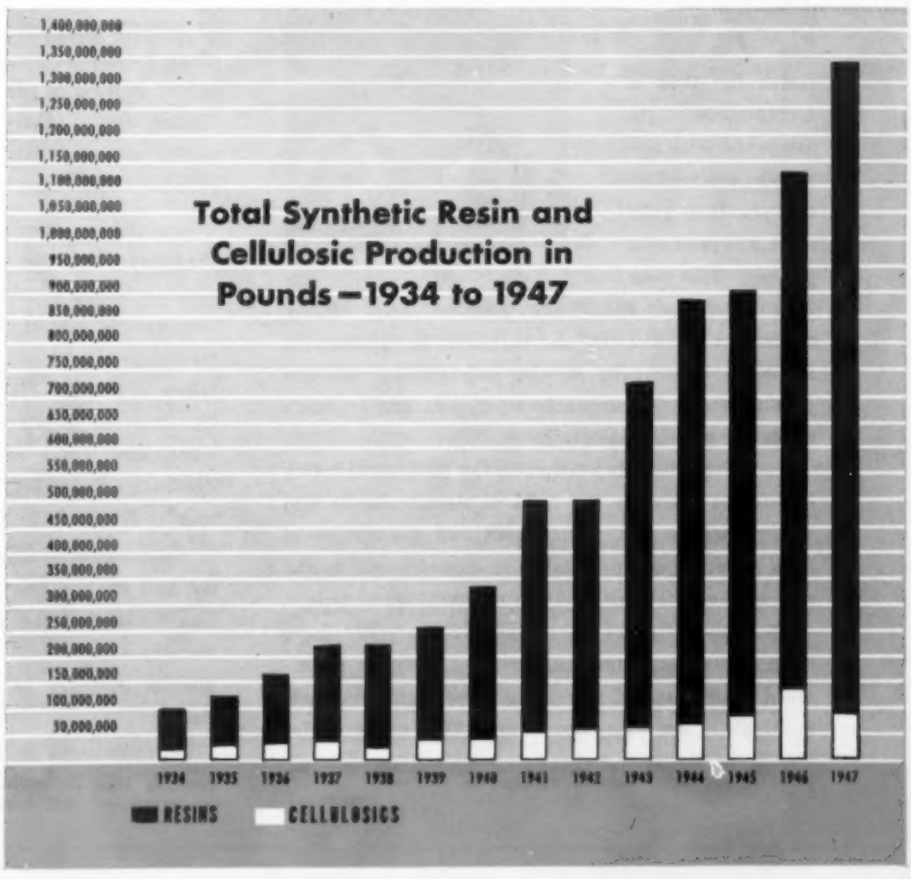
Insofar as molding materials were concerned, the slump was not unexpected. Far-seeing executives had often pointed out that saturation of some standard markets was certain eventually to react on the phenolics. The break came last Summer after a record-breaking month in March when almost 20,000,000 lb. were consumed. The lowest month was July with 11,000,000 pounds.

One of the major producers was shut down due to a strike during that period, but the other companies failed to experience a noticeable increase in orders at that time. Thus there is a tendency to discount any effect the shutdown might have had on total production.

Consumption was back up to around 16,000,000 lb. in the Fall, which probably indicates that the slump was temporary; nevertheless, there are elements at work in the compression molding industry which require remedying.

In addition to saturation of prime markets, which, after all, is only a temporary condition, there are perhaps more fundamental reasons for the phenolic molding situation in 1948. In the first place, the industry consumed more molding powder in 1948 than in any year in history except 1947 when consumption was high because all industry had been starved for phenolic parts since war-time. When the material came into free supply, everyone rushed to obtain parts for the booming electrical, radio, washing machine, and other industries.

Previous shortages had resulted in a "fear" psychology by the users of phenolic parts, who worried over the possibility that they wouldn't have enough to meet an increasing consumer demand, and they laid in big inventories. One manufacturer, for exam-



ple, is reported to have made more iron handles during this period than the whole country consumed in any pre-war year. This influence dominated the phenolic industry in 1947 and through March of 1948. Consumption of molding powder dropped off 40% in the Summer and popped up again to around 16,000,000 lb. in September. But there was still an over-abundance of idle press time. Molders had become accustomed to using from 18,000,000 to 20,000,000 lb. monthly, and anything less was disheartening. Even at 20,000,000, they had idle press time.

The fact seems inescapable that the capacity of phenolic molders to produce has at least quadrupled since 1940, and they haven't found a way to use all that capacity. New and faster presses, pre-heating, improved techniques, and better plant layout, have all contributed to this situation. With all this capital investment at stake, a molder must have larger quantity sales. A man who had a break-even point at $30,000 before the war might have to reach $100,000 today. So, despite the fact that phenolic molders used more than twice as much material in 1948 as in pre-war years, they were down in the dumps because they hadn't used more.

A highly controversial point is the part that competition has taken in the drop on the phenolic chart. Thermoplastics and other thermosetting materials, as well as non-plastic materials, came into more free supply. Naturally they were taken back into some of the applications where the use of phenolics had been extended to almost complete coverage because of other shortages. Clock housings, for example, are no longer 100% phenolics. Then there were other applications, such as telephone bases, where butyrate made substantial inroads. Many plastics are well fitted for radio cabinets and although phenolic users are adamant in insisting that they will always have a major portion of this market, there is no denying that thermoplastics have captured a portion of the field. Probably more important at the moment is the fact that the demand for radio cabinets has been surfeited.

The bright side of the phenolic picture is that metals are still short and will continue so for some

New Records for the

THE plastics industry continues to expand. Estimated production of synthetic resins for 1948 is 1,400,000,000 lb. compared with actual production the previous year of 1,251,699,000 pounds. The year 1946 produced 994,277,000 pounds. This steady expansion is due to an increase in production facilities, broadening of the markets for plastics products, and innumerable new uses for products made of plastic materials.

An outstanding expansion in the plastics industry has taken place in the field of thermoplastic film and monofilaments. Fabricators and converters of both products are producing at capacity and in the case of the latter are building up backlogs of orders.

The properties of thermoplastic materials have been so well accepted that, coupled with the downward adjustment of prices for these materials, their application has been broadened. This accounts for the notable growth in the injection molding field of the plastics industry.

Decorative laminates are increasing daily in public acceptance. Industry's use of component parts of all categories continues to increase due to some extent at least to the remobilization program of the United States Government. The combination of plastic materials with glass fiber is increasing and entering new fields of end-use application.

Establishing standards of quality is important in the plastics industry as in many another industry and manufacturing elements in this field are becoming increasingly conscious of the necessity for setting minimum standards. Standards programs undertaken in 1948 by The Society of the Plastics Industry covered polystyrene wall tile, melamine tableware, and vinyl film and sheeting. In addition, decorative laminators have come forward with a standard for their products.

Informative labeling is a correlary to this activity and such a program has been inaugurated by The Society of the Plastics Industry. It is an all-encompassing effort covering all branches of the plastics industry as well as the retailer and consumer.

Merchandising in the plastics field is gradually coming into its own. More than one plastics com-

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time. This leaves open an unlimited market for those who have the ingenuity to find holes in metal applications and fill them with phenolics.

Another competitive angle so far as custom molders are concerned is the tendency for users of molded products to establish their own molding departments. Some of them will probably stay in plastics just as some of the electrical companies have done in the past, but there will also be defections. Some executives established molding plants because they have had difficulty in obtaining the design and quantity of moldings desired. When the nation returns to a normal economy, these deficiencies will be eliminated, and some plant managers may find that they can buy molded parts more economically than they can produce their own.

The mild shock administered to phenolic molders in 1948 when business failed to exceed 1947 will probably serve as a stimulant to developing new business. In the shortage years, new uses did not grow, but now healthy growth of uses will further develop the industry.

Indications that new products are under way can be found in tool shops where molds are under construction, but most of them are still in the confidential stage. One that points up the tendency to mold larger pieces is a dresser drawer to be molded from wood-filled compound. The filler may be modified with flock later, just as in the case of washing machine agitator compound. The same thing was tried unsuccessfully years ago, but new techniques now make it look practical. From dresser drawers to other pieces of furniture and large size moldings is only a step. A kitchen cabinet for attachment to walls is another probability.

Work on molded laminates is also progressing nicely, with such items as window frames and stair tread and riser covers under consideration. Even a small piano with a molded sound board is a possibility. These things may be out of line for most compression molders, but it has been a frequent incident in this industry to have new products come from the hands of men who "didn't know it couldn't be done." (*Please turn to next page*)

Plastics Industry by George H. Clark*

pany has installed modern merchandising methods which up until a year or two ago were conspicuously lacking.

By accepting the already offered cooperation of consumer and retailer groups, the S.P.I. hopes to put into effect as quickly as possible its plan for informative labeling of plastics products.

Members of this industry are already concerned with the remobilization program of the United States armed forces. Should the call come for an all-out effort, they are particularly well organized to fulfill their responsibilities. The executive personnel that handled the industry's World War II production problems are still in the saddle and can assure the utmost in production capacity in an emergency.

The Munitions Board and the National Resources Planning Board are activating the country's remobilization plans. While their program resembles that which the government undertook prior to World War II, it is dissimilar in that the men who are charged with the responsibility of organizing this effort have had considerable practical wartime experience. The result is that the entire procedure is going forward more expeditiously. If defense requirements do not reach a disturbing volume in 1949, it is believed that the industry can look forward with a feeling that it will have all of the materials needed for maximum production and will be able to make use of all the new developments and equipment that are available. It behooves every member of the plastics industry to investigate the likelihood of being called upon to produce defense items.

Generally speaking, it is apparent that over a period of time the plastics industry is headed toward larger and more efficient producing units rather than toward smaller and less efficient units. Trends in the industry indicate that the urge of enterprises to enter the plastics field is lessening because technical processes become more complicated daily and because there have been developed expensive new equipment and improved processes that lower the cost of production but increase capital investment.

The plastics industry is completely reconverted from war-time output. It has almost completely free access to materials and equipment. Plant expansion in the processing divisions is almost completely finished according to plan. If the programs in standardization, informative labeling, customer relations, and merchandising come to rapid fruition, everything points to a greatly increased volume in 1949.

There are, of course, many possibilities in the phenolic field aside from molding. These include such things as brake linings and abrasive bondings which have grown so large that the materials manufacturers have set up separate departments to handle them. Mineral wool bonded with phenolic liquid resin is now manufactured by more than 10 companies. Floor coverings frequently employ a phenolic binder. Honey-comb cores for laminating to aluminum or plywood for structural panels haven't gone as far ahead as expected but are still a promising possibility. Phenolic molding compound modified with rubber is also behind expected wide-scale use but certainly appeals to the imagination because of its impact strength.

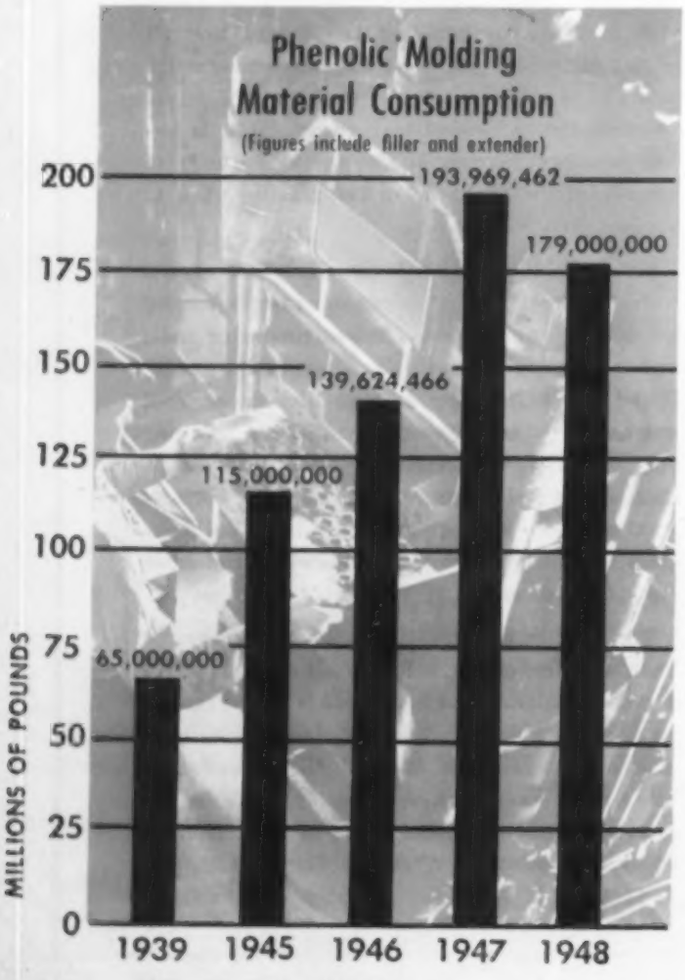
Most exciting of all current possibilities is the use of phenolics with wood. A phenolic-treated paper for surfacing plywood that will withstand severe weathering was announced during the year. Its structural use seems assured. Then there is a wood laminate coming along that may fit in particularly well in the construction and furniture fields. It consists of a core of Southern pine, a crosswise layer of a phenolic impregnated paper, and a layer of aluminum with a phenolic paper coating on each side, the entire structure being faced with wood veneer of any type desired. The resulting laminate will compete pricewise with any material intended for similar uses.

Still another, and perhaps eventually the biggest, use of phenolics in the wood field is in combination with sawdust and scrap. It is claimed that a product employing 10% or less resin can be made for 6¢ a board foot, or about $60 per M board feet, and can be used as lumber in most any application where wood is needed. Resin producers estimate they will be selling at least 1,000,000 lb. of resin a month for this material by the end of 1950.

The phenolic industry aims to hold its position as one of the leading tonnage producers in plastics. It has had its trials and tribulations but is like the pioneer of Colonial days who had just reached the peak of the Alleghenies and saw the great expanses of water, timber, fertile land, and resources in the great Ohio Valley. He had traveled through a promising land, but what he saw to the west exceeded all expectations—his future was just beginning. So, too, in phenolics. The last 10 years of expansion is nothing compared to what is ahead. The industry now has more reason to look ahead to a future of some 1,000,000,000 lb. production per year than it had in 1924 to think of a future time when it might produce 200,000,000 lb. per year.

And when the phenolic expert who had expressed himself with the above eloquence had finished, he turned to the writer and said: "Sir, I have just seen a *phenolic rivet!*"

The last three months of 1948 are estimated. Other figures used are based on monthly reports issued by the United States Census Bureau and United States Tariff Commission



VINYLS

FASCINATING — PUZZling—helter-skelter. Plastics is a wonderful industry for those who seek excitement, razzle-dazzle, and uncertainty. And the vinyl branch of the plastics industry in particular, which may outdistance all other plastics in total poundage if present trends continue, is no place for the weak-hearted. It is as full of surprises, triumphs, and disappointments as the 1948 elections. A player can sit in on this vinyl game with a full house in almost every hand and still go home a loser; conversely, he may win with just an occasional three-of-a-kind. It is the kind of an industry where so much is going on that no human mind can encompass all its ramifications, and what is truth today may become falsehood tomorrow.

The still infant chemical industry is no stranger to fast-moving, rapidly-developing projects, but it is doubtful that many chemical products will show so

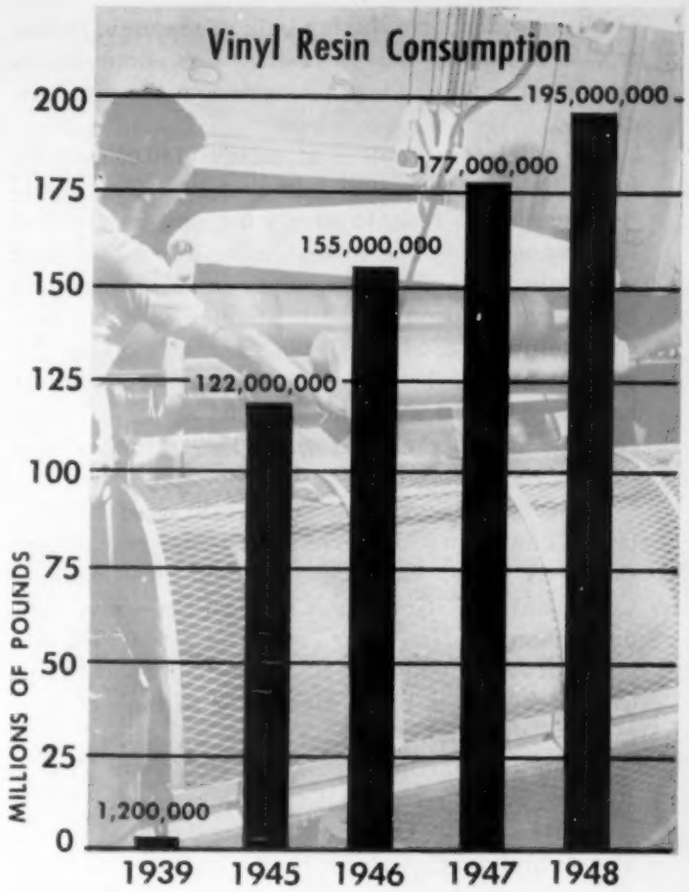
much versatility in a given field as the vinyls. Here also is offered great latitude for wide-spread development, but with so many imponderables that workers with vinyls are nearly always on the anxious seat while waiting the results of their development and promotional efforts.

The vinyl chlorides and copolymers are essentially a third leg of the plastics industry. They have brought in new techniques and gone into markets with which the other parts of the plastics industry are not particularly familiar. They have entered the rubber, fabric, electrical, furniture, floor covering, packaging, toy, shoe, automobile, electroplating, printing, vat lining, recording disk, paint and lacquer, and many other industries, either as competitors with present materials or as contributors on their own to the individual industry's progress.

A mass market looms before vinyls which is comparable to that which opened out to rayon and nylon when they were first introduced. The vinyls may never create the stir aroused by cellulose fibers and nylon in their competition for fabric markets, but the vinyls do have a more universal application in other than fabric fields, and their total impact on industry is potentially greater than those plastics used primarily for fabric. There may come a day when structural parts employing other plastics will put vinyl poundage in the shade—and there is always a possibility that chemists will formulate another material to cut into the vinyl market—but there is nothing presently forseeable that threatens to curtail this material's steady growth. The polyethylene and styrene families also have great potentialities, of course, but there is little likelihood that they will catch the vinyls for several years at least.

The very rapidity of the vinyl industry's growth since the war, and its fan-like spread into all types of business, makes it a most difficult field to review. The woods are full of researchers trying to fathom its intricacies, markets, and processing methods for clients who want to get in the swim, and in almost every case the first thing they bump into is a confusing array of statistics that shed only partial light on the size of this industry's operations. We, too, realize that our figures are not complete and are likely to contain a more than normal margin of error. Reasons for these uncertainties lie in the facts that the industry is not yet old enough to have a well organized, universal record system; that nomenclature varies from company to company; and that competitors want to prevent their size and type of operation from being known to each other. Thus it is that while the accompanying tables are not presented as absolutely rock-bottom certainties, it is reasonably certain that they are close enough to give a good picture of industry operations.

The government figures in Table II have been torn apart because they contain numerous entries



Consumption figures include all types of vinyls—polyvinyl chloride and copolymers, polyvinylidene chloride, butyral, formal, acetate, and alcohol. The 1939 figure is estimated. All others, except 1948, are from annual Tariff Commission reports. No annual Tariff report is available for 1948, which is here estimated from monthly reports, with about 35,000,000 lb. of plasticizer deducted from the "Sheeting and film" figure given in Table II on page 62 because it was reported as compound rather than solid resin

of vinyls other than vinyl chloride and copolymers, and even the vinyl chloride figures are confusing because some are based on resin plus filler compound, and others are for resin only.

Table II is presented as a part of the industry's official record and because it gives a base for comparison with other years. However, much closer scrutiny of Table III is invited. Here the figures refer to polyvinyl chloride and copolymer resins only. Filler has been completely separated from resin, and all such things as vinyl butyral, vinyl alcohol, vinyl acetate, etc., have been omitted except as they enter into the field as copolymers with vinyl chloride.

The figures in Table III were obtained by consultation with members of the industry whose job it is to know what is going on and with research men who are examining the vinyl field. The various estimates were then compared with each other and with published reports such as those of the U. S. Census Bureau and Tariff Commission. The reader will quickly observe by comparing the tables that the

vinyl chlorides form the big bulk of the vinyl industry. It is largely the vinyl chlorides about which people are talking when they mention the vinyl industry.

The total consumption of around 140,000,000 lb. in 1948 represents a 40% gain over 1947. The industry had enough resin to supply demand for the first time since it became available for other than war materials, although orders were running behind late in the year. No one expects another such big percentage upsurge; although poundage will go up, the percentage will be less. The industry is aiming at between 170,000,000 and 200,000,000 lb. of vinyl chloride and copolymer resin in 1949 for other than protective coating uses.

Capacity has skyrocketed to an estimated 250,000,000 lb. annual production of resin—some researchers say even more. The biggest producers — Bakelite Corp., and B. F. Goodrich Chemical Co.—have both more than doubled their capacities since 1945 and could probably add more in a reasonably short time. Their present combined capacity is perhaps 80% or more of the total.

Glenn L. Martin, Monsanto, Goodyear Tire & Rubber, and Firestone all came into production in late 1947 or 1948. Other companies continue to talk about vinyl production but have announced no plans. Shell Chemical can make monomer in small experimental quantities and has a polymerization plant in Holland. Dow Chemical makes monomer for its own use and sells sizeable quantities—is always a possibility for entrance into the polymerization field. And there are several other companies still flirting with the idea of entering the vinyl field, but for the time being at least, it would seem that capacity is running ahead of demand. At least, it would be if all present producers were operating at their limit. Furthermore, there is still not enough satisfactory plasticizer to match the resin production although rapid inroads are being made on that particular shortage.

Tables II and III now need some reconciling. In Table II under the heading "Sheeting and film" is included some 10,000,000 or 12,000,000 lb. of vinyl butyral used in safety glass, as well as all filler and plasticizer used in film and unsupported sheeting ranging from 4 to 24 mils thickness. In Table III the resin and filler have been separated and all material over 10 mils thick has been classified as unsupported sheeting. The butyral is omitted from Table III. The textile and paper coating classification has likewise been separated in Table III in order to give some idea of the amount going into coated fabric for use in upholstery and other items.

In the "Molding and extrusion" column in Table II, enough evidence is found to indicate that, in figures reported to the government, there may be cases where compounds have been reported rather than solid resin. Regardless of the reason for variation, leading producers insist that there has been no such amount of resin going into molding and extrusion as is indicated in Table II. Furthermore, they point out that extrusion compounds for wire and cable vary from 40 to 60% in resin content. Also included in this molding and extrusion category is the saran output which is not a publishable figure unless included with other materials. Another variant is the vinyl used in record disks and rigid vinyl, which requires no plasticizer. From all these complicated factors is derived an arbitrary figure for 1948 of 40,000,000 lb. of polyvinyl chloride and copolymer resin and 64,000,000 lb. of compound under "Molding and extrusion" in Table III.

The miscellaneous figure in Table III includes such things as resin for floor coverings, adhesives, and protective coatings.

The real success story of vinyl in 1948 is to be found in the production of film, largely in the 4 and 6 mil calendered category. In that field there was

Table II.—Total of All Types Vinyl Resins Consumed in 1948 According to Government Statistics.

	Sheeting and film[b]	*Coating*	*Molding and extrusion*[c]	*All other*[d]	*Total*
January	7,784,527	2,414,438	7,823,309	1,531,470	19,553,744
February	5,980,191	2,102,156	7,601,313	1,950,640	17,634,300
March	7,537,151	3,053,490	6,767,151	1,679,557	19,037,349
April	7,467,905	2,937,881	6,725,444	2,066,646	19,197,876
May	6,350,610	2,318,445	5,679,994	1,596,574	15,945,623
June	7,193,864	2,088,520	4,311,978	1,593,629	15,187,991
July	6,892,613	2,592,701	4,141,981	1,368,068	14,995,363
August	8,290,798	2,612,772	5,361,281	1,833,664	18,098,515
September	10,298,267	2,924,474	5,919,799	1,845,282	20,987,822
Totals	67,795,926	23,044,877	54,332,250	15,465,530	160,638,583
Last quarter[e]	35,000,000	10,000,000	20,000,000	5,400,000	70,400,000
TOTALS	102,795,926	33,044,877	74,332,250	20,865,530	231,038,583

[a]Figures from U. S. Bureau of Census and Tariff Commission.
[b]Includes fillers, plasticizers, and extenders, and polyvinyl butral used in safety glass.
[c]Includes saran.
[d]Excludes data for protective-coating resins. Includes polyvinyl acetate, polyvinyl formal, polyvinyl alcohol, and any polyvinyl chloride not listed in above categories.
[e]Last quarter estimated.

Table III.—Consumption in Pounds of Polyvinyl Chloride and Copolymers Only, 1947—1948.

	1947		1948		
	Resin only	*Total poundage with filler*	*Resin only*	*Total poundage with filler*	*Percentage of resin*
Film (under 10 mils)	18,000,000	27,000,000	30,000,000	45,000,000	66
Sheeting (over 10 mils)	22,000,000	34,000,000	28,000,000	44,000,000	64
Fabric coating	14,000,000	25,000,000	20,000,000	36,000,000	55
Paper treatment	3,000,000	4,600,000	2,500,000	3,800,000	65
Molding and extrusion	30,000,000	45,000,000	40,000,000	64,000,000	[a]
All other, including protective and surface coatings	12,000,000	15,000,000	20,000,000	24,000,000	82
TOTALS	99,000,000	150,600,000	140,500,000	216,800,000	

[a]Varies from an average of 50% for wire coating to 100% resin for rigid vinyl.

such heavy production towards the end of the year that there was a general fear of overstocking, such as occurred in shower curtains a year and a half ago. All through 1948 there was a certain amount of price cutting brought on by stiff competition; dumping of inferior goods; use of scrap in film making formulations; the inevitable struggle that follows when inexperienced hands try to get in on a good thing; and the jockeying for position that always goes on when rivals attempt to out-maneuver each other for control of choice merchandising outlets.

To add to this confusion, and perhaps as a result of it, several large buyers became disgusted with the price situation and sometimes with the quality of goods delivered to them. These same buyers now berate plastics because of this experience, but will soon be asking for more for the simple reason that they won't be able to resist their customers' demand for vinyl film.

These surface problems are cited only because the shrieking about them is out of all proportion to any harm that has been done to the film market. They are symptoms of a rapidly growing industry that picks up more burns and scratches in its headlong growth than one which grows less rapidly and can pick its way more carefully.

Generally speaking, all phases of the vinyl film industry are on the upgrade despite complaints, and even the threatened over-production is only a temporary situation. Any over-production—or maybe it should be called excess inventory—will be tough on those processors with inferior quality goods or without well-established distribution outlets. The vinyl film industry as a whole, however, is prepared for any such temporary shock by the knowledge that film is now spreading out over a horizontal market; when supply meets demand for such things as shower curtains or table cloth covers, processors can switch to drapes, window curtains, yard goods, etc.

Optimism runs high among vinyl film processors who point out that not one home in twenty has yet acquired a table cloth or bridge table cover; that at least four windows in many homes will some day be decorated with vinyl curtains; that more and more women are buying yard goods for making up their own curtains, covers, etc., which they can often buy at 50¢ a yd., in comparison with fabric at $1.50; that one processor printed and sold 1,000,000 yd. of one pattern for table cloth covers; that a New York department store recently sold $50,000 worth of matched vinyl ruffled bed spreads and dresser scarfs in one week and at a price far below satisfactory fabric covers; that another New York store is advertising nursery rooms completely equipped with vinyl protective film for all types of equipment needed when caring for babies. Scores of similar examples could be given as further evidence that the industry has overcome its original tendency to concentrate on one or two items.

Improvements in vinyl materials and technique are matters of almost week-to-week development. Research on plasticizers is continuing to solve problems of brittleness at low temperature, migration, and spewing. Better stabilizers to improve heat and sunlight resistance are promised for the near future. Heat sealing of vinyl film is not yet foolproof, and there is considerable difference of opinion as to where the most improvement can be made. Processors claim that many difficulties come from slight variations in film thickness, yet compounds now on the market are guaranteed to give heat sealing satis-

Table IV.—Percentage and Amounts of Vinyl Resin Used for Film, Sheeting, and Coated Fabric in 1948.[a]

	%	*lb.*
Household use, including nursery items and yard goods	40	31,000,000
Upholstery	36	28,000,000
Wearing apparel	8	6,500,000
Handbags	6	5,000,000
Coverings for radios, luggage, etc.	2	1,000,000
Miscellaneous, including wall covering, bookbindings, etc.	8	6,500,000
		78,000,000

[a]Estimated after consultation with members of the industry.

faction. Another problem is in sealing printed film, where it is claimed that the ink film sometimes prevents good adhesion. One processor asserts that if the compound is strained carefully before calendering, there will be less trouble with thickness variations and consequently better results in heat sealing.

One of the outstanding examples of better heat sealing techniques is found in raincoat production. Sewing of vinyl film was never particularly successful because fabricators were slow to learn that vinyl required a different technique than fabric—that round needles, long stitches, and nylon thread should be used. Sewn under-arm seams and button holes pulled out. Heat sealing lessens the tendency for seams to open up. One raincoat manufacturer eliminated all sewing; used snaps or zippers instead of buttons and double layers of vinyl to reinforce the pockets, zipper, or snaps; sealed on a hanger strip at the back of the neck; used the new metallic colors to give style and newness—and sold 200,000 raincoats in the first five months of 1948. Each raincoat required about 1 lb. of compound.

Still another interesting raincoat development has been an increase in the thickness of the film from 4 to 6 mils. The added heft gives a bit more neatness and luxuriousness to the garment. It is also interesting to note that the United States Army is experimenting with a 4-mil coat to match the blue serge of the new USAFF uniform and 3-, 4-, and 6-mil coats to be worn experimentally by soldiers in the Washington, D. C., military district.

Printing on vinyl film has made remarkable progress during the year. First, better inks, most of which contain vinyl resin and fuse with the film, are now available. No one should ever again accept film from which ink can be flaked off with a finger nail. Hand coloring with designs taken from the Great Masters has become a vogue during the year. Screen printing is still desirable for the fancier patterns. Process printing similar to that used on paper or fabric is probably most common in the industry. Gravure and reverse printing are becoming more popular because they seem to give an impression that the printed color is more nearly a part of the film. In reverse printing the under side of the transparent film is printed so that the design will show through; in coated material the front surface is printed and then coated with transparent vinyl. In gravure printing, sometimes called photogravure, etched copper rolls are used. Some processors print or emboss from hot rolls as the film comes off the calender and thus have a continuous operation. The resulting economy is obvious.

An interesting trend in the vinyl film business is the increasing tendency for textile men to move in. They are, of course, natural fabricators and printers of film, and several have established large volume film production plants. Their influence in marketing, designing, and styling is probably a great aid to the plastic film industry for they know their way around in the distribution channels where film must be marketed, and their experience and intuition can be helpful to the plastics industry. The time has come when the production of a good vinyl film is taken for granted—nearly every processor can and does produce an acceptable item. Design, pattern, and distribution are now the key requirements and textile men are eminently qualified to sense the designs that will win consumer approval and to choose the most desirable and efficient outlets for reaching the customer.

The vinyl film situation cannot be dismissed without a brief word about cast and extruded film. Extruded film was used for gun covers in the war and is now employed in various formulations for special packaging—such as for oleomargarine—but many other possibilities are in the offing. Extruded film is likely to have strains and consequent resulting shrinkage in the finished product so that it wouldn't be applicable for such things as shower curtains and garments, but a number of other outlets are in the experimental stage.

Cast vinyl film is particularly applicable in the thin gage market because better transparency can be obtained. A great deal of work has been done with it in the fabric field for window curtains and drapes where the casting apparatus has been coupled with printing presses in a continuous operation. Some operators claim that superior goods can be obtained in this manner but the cost is higher than by the calender method.

Sheeting or unsupported material of 10 mils thickness and up showed a substantial growth in 1948—see Table III—but not as great as film. Furthermore, sheeting is not expected to increase as much as film in the future because its market, largely in upholstery and hand bags, is thought to be partially saturated. Other markets such as coverings for luggage and radio cabinet coverings may increase, but producers are not counting on this branch of the vinyl industry to grow as fast as film.

There has also been a tendency for vinyl coated fabric to move into more competition with unsupported sheeting now that the fabric is in better supply and cost is down slightly. There are authorities who insist that the trend toward coated fabric will become more noticeable in 1949, especially in the upholstery field where some upholsterers claim they want the added strength imparted by fabric. Unsupported sheet boosters, on the other hand, insist that proper technique in applying the sheet will eliminate danger of tearing and that coated fabric does not have the drape or luxurious feel of unsupported sheet. For industry estimates of vinyl resin use in film, sheeting, and coated fabrics, as compared with figures given in Tables II and III, special attention is invited to Table IV.

It also seems quite obvious that pyroxylin coated fabric is now suffering from the impact of vinyl and will suffer more. It will be down perhaps 35% in 1948 from 1947. Here are some interesting figures on the coated fabric industry recently compiled by a competent authority:

1939—55,000,000 yd. of pyroxylin coated fabric
1947—80,000,000 yd. pyroxylin coated fabric
50,000,000 yd. vinyl coated fabric
20,000,000 yd. unsupported vinyl of 10 mils thickness and up
1948 estimate—50,000,000 yd. pyroxlin coated fabric
60,000,000 yd. vinyl coated fabric
25,000,000 yd. unsupported vinyl sheet

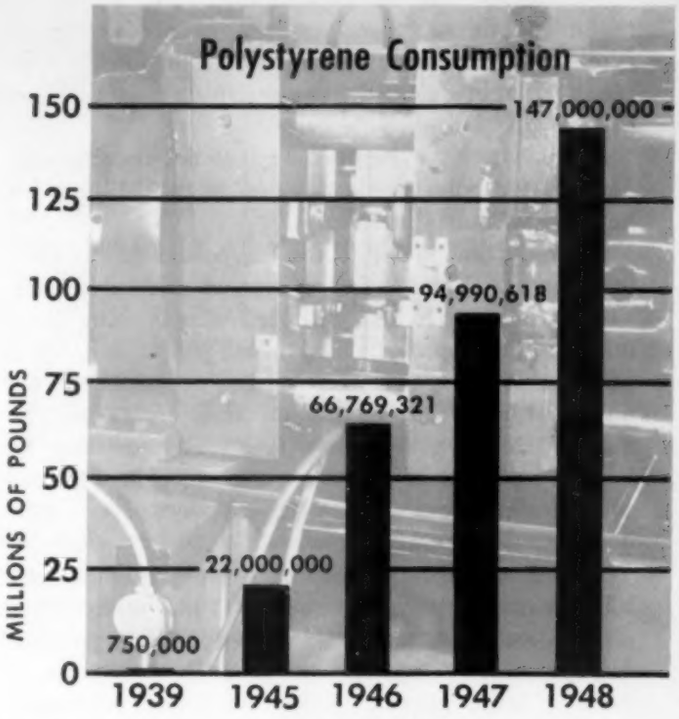
It has been further estimated that the upholstery market would use a total of some 40,000,000 yd. of vinyl material and less than 8,000,000 yd. of pyroxylin coated cloth in 1948. The automobile industry, however, still seems to be using about 50% pyroxylin coated material for inner linings, trim, tops, kick plates, etc. Estimators figure that every automobile in the country averages about 2 yd. of coated or unsupported material, with Fords running over that average and General Motors cars under; busses and truck cabs average higher; and taxis may average 8 to 10 yards. Pastes and plastisols are growing in acceptance in the vinyl part of these applications, with coated fabric running a close race to catch up with unsupported sheet.

(*Please turn to page* 137)

POLYSTYRENE

THE DARLING OF THE injection molders is Miss Polly! She is largely responsible for having made it possible for them to increase their consumption of all thermoplastic molding materials from less than 100,000,000 lb. in 1945 to around 200,000,000 in 1948. And the end is not yet. Record breaking consumption of around 15,000,000 lb. of polystyrene a month in the latter part of 1948 presages another record breaking year in 1949. The near 150,000,000 lb. total in 1948 represents a 55% increase over 1947 and that year was 42% over 1946.

The larger increase in 1948 was probably due to easier availability of material than in other years. Some estimators figure that an increase of 25% in 1949, to about 185,000,000 lb., is optimistic, yet there is always the possibility that increasing use of some application like wall tile will skyrocket into big proportions and upset all calculations. It is believed that producers can supply at least 200,000,000 lb. in 1949, especially since Koppers and Bakelite are now in full scale production. Furthermore, additional units could be added without long delay if demand warrants their installation.



Late returns indicate 149,000,000 lb. for 1948. Other figures used are based on monthly reports issued by the United States Census Bureau and United States Tariff Commission

One producer insists that a 10% increase in 1949 is all that can be expected. The year 1948 was the first in which the material was plentiful. From now on more new ideas for products must be developed and it takes time to work them up. Consequently another mushroom growth is not likely, in that producer's opinion.

Several months in the first half year always seem to show a decline in consumption. Polystyrene dropped to 8,000,000 lb. in February 1948 and was down around 10,000,000 in several other months. The big production in 1948 was intensified in the fall when consumption reached over 15,000,000 lb. in one month, or the equivalent of a 180,000,000 lb. annual rate for the industry.

A slight factor involved in polystyrene statistics is in the possibility that the government consumption figures may contain some duplication. Several companies are doing large scale coloring of crystal polystyrene and it is possible that several million pounds of the same polystyrene have been entered on the government reports by both the crystal producer and the company that does the coloring.

The raw material situation for producing styrene monomer seems well in hand at the moment. Ethylene, which ran short in 1947, is now in good supply and the benzol supply seems adequate. Styrene availability still hinges largely on the syn-

thetic rubber program. As long as production of synthetic rubber is held to no more than 400,000 tons annually, there should be enough styrene to meet present plastics needs.

At this writing everyone seems to believe that any demand for polystyrene developing in 1949 can be handled without difficulty.

An important factor in the big poundage for 1948 was the steadily increasing size of molded pieces. The refrigerator industry in particular is using large numbers of crispers, baffles, throat pieces, and other fixtures, with one baffle reported as containing 30 oz. of polystyrene and having an area of 364 square inches. Refrigerators now frequently employ at least 8 to 10 lb. of polystyrene each; they now account for the largest poundage of polystyrene, with housewares running second.

Among other large moldings are pastel colored toilet seats. They are not cored out like many other plastics seats, but are solid pieces weighing almost five pounds. A 9½ lb., one-piece battery case is another large size article. Polystyrene producers insist that their material has permanently taken over a good portion of the radio cabinet business. Color is a deciding factor in many cases. Higher heat-resistant polystyrene has been helpful because it allows more flexibility of design; but if good ventilation is incorporated in the design, standard polystyrene is adequate.

Large piece molding presents difficulties because of strains induced by molding and in use but if the strains are controlled they may contribute to a tougher finished product. One producer is supplying a polystyrene emulsion treated glass mat to be placed in the strain positions in the mold to help give added strength to the finished piece.

Polystyrene wall tile is increasing in use but inadequate distribution has held back even larger production. Several manufacturers with nation wide distribution have now taken hold.

There has been intense activity in merchandising polystyrene products during the year by both of the larger producers. Monsanto has tied in its national advertising with molders' products to help encourage better distribution. Dow has put on one of the most comprehensive advertising-distribution campaigns ever attempted in the plastics industry with a promise to users that its company's trademark is indicative of a product that has been certified as a sound plastic application. The success of the campaign seems obvious since the company plans to expand its advertising into mass media and will add more classifications to its "promotional packages" in the year 1949.

Improvements in polystyrene last year were marked by increased consumption of Monsanto's higher heat-resistant material and Koppers' introduction of a new heat-resistant compound to be sold at standard price. Dow joined the parade with announcement of a similar material, but has not promoted it. Chances are that much higher heat resistance may be expected in the near future. Another noticeable improvement, according to some molders, has been in the clarity of some producers' compounds. Further improvement of annealing technique to aid heat resistance and more widespread use of coating compounds that may be spread over polystyrene to improve scratch resistance and lessen static attraction were noticeable.

Two new formulations announced by Dow at the Exposition in New York in September have aroused great interest. One is a more light-stable compound that will help to prevent any yellowing of polystyrene when used in lighting fixtures. The other is a more flexible material with greatly improved impact strength. The color range is somewhat limited at present. Company officials state they are making no claims that this material is as tough as some of the cellulosics, but its strength is considerably above standard polystyrene. Since its price is only a few cents more, molders are expecting the new material to broaden their line of applications for polystyrene to a considerable extent.

Molding powder still accounts for over 90% of polystyrene production, but other things are beginning to develop now that material is available for experimentation. Extruded polystyrene, which may currently account for from 2% to 5% of all consumption, is developing slowly but apparently with promise. Filaments for brushes and brooms have been on the market for some time—improved technique will undoubtedly increase uses and volume within the next year or so. Large size extruded sheets are now being tried as overlays on refrigerator inner door panels and have also been suggested as wall board to replace tile, as dashboards in automobiles, and in other sizeable pieces. A polystyrene paper base laminate is also a possibility, not for table tops, but possibly for walls. (*Please turn to page* 139)

CELLULOSICS

CONFRONTED WITH serious competition from other materials, cellulosic molding materials fell off again in 1948, but producers feel confident that the spurt evidenced in the latter part of the year will continue on into 1949 and beyond. Even though other thermoplastics also spurted at the same time to indicate a general uplift in all injection molded products, the cellulosic increase in the fall to around 4,500,000 lb. a month (exclusive of ethyl cellulose) from a low of 3,400,000 lb. in June and a high of 4,000,000 lb. in March

Plastics Materials Progress

by J. R. Hoover*

LESS spectacular than during war-time or the immediate post-war years, less in rate than some makers had anticipated, the 1948 growth in plastics materials production was nevertheless large and healthy. The industry enters 1949 with fewer "bottlenecks" and greater productive capacity than ever before.

Expansions in basic chemicals—formaldehyde, urea, and phenol—have brought the thermosetting resins generally into balance with demand. The major thermoplastics, too, with the exception of polyethylene, are reported to be in adequate supply for current and anticipated 1949 needs. The shortage of polyethylene has been substantially relieved by completion of new plant facilities late in 1948. Steps are being taken to make greater supplies of good plasticizers soon available for the growing vinyls.

With more kinds and freer supply of all plastics, product engineers and designers can choose materials for their functional, decorative, and economic values, can aim high in quality and low in cost—necessary conditions for continued sound progress in our industry.

Plastics is a dynamic modern business with its roots in research. The search goes on, with better and better tools. New materials, improvements in the old, better methods of processing and fabrication will continue to come along. New materials seldom put the old out of business. A large and relatively new class of plastics are the elastomers, typified by the vinyls and polyethylene. Their general effect has been to widen the entire plastics horizon and therefore indirectly to benefit all plastics rather than to displace other types.

The plastics industry is many industries. Many industries are in plastics. Companies in long-established manufacturing industries have made molding, extruding, calendering, coating, or other plastics processes an important if secondary part of their broad operations; companies whose entire business is plastics have taken over the manufacture of products formerly made by other industries from other materials.

By way of example: both the rubber industry and the plastics extruders are making vinyl garden hose; toy manufacturers are in plastics and plastics molders are making toys; electrical manufacturers are in plastics and plastics molders and extruders are making electrical parts; textile makers and converters use plastics and plastics processors have given plastics film and sheeting the status of a new textile; metal and wood working industries are turning to plastics while at the same time plastics plants are making products to compete successfully with metals and lumber; plastics are used by the leather industry in finishing and the calenders and coating machines in plastics plants are turning out better-than-leather upholstery.

All these examples point to plastics as an indispensable part of our national economy. The resourceful plastics man need not worry about other industries "taking over" his business, because the reverse process is going on equally fast.

*President, Plastic Materials Manufacturers Association, Inc., and vice-president, B. F. Goodrich Chemical Co.

indicated that cellulosics were in a stronger position. The late season increase was cited by producers to prove that they had won back some of their last market when customers found that cellulosics had properties, such as toughness and impact strength, which made them more suitable than other thermoplastics for certain applications.

Pointed out as typical applications for cellulosics in the toy field, for example, are miniature vehicles which are required to take a lot of banging around —motor housings for toy building sets, dolls, gun stocks—anything that must withstand the punishment resulting from youthful exuberance. If run-of-the-mine acetate won't do, then high acetyl acepropionate, butyrate, or ethyl cellulose can take over. Further, as another example, butyrate is now the most commonly used plastic in telephone bases. Other cellulosics are under experiment for the handpiece, and the possibility of using colored cellulosics for both molded base and hand set suggests a possibility for employment of big poundage. A variation of this is found in colored acetate and butyrate sheaths for phenolic phone set bases.

Development of a flame resistant acetate to meet Underwriters' Laboratory specifications is expected to be a boon to acetate, particularly for use in hous-

ings. Housings and parts for electric shavers, lightning arresters, Christmas tree lights, cake mixers, and vacuum sweepers have already been successfully molded of this material.

Our estimated breakdown of cellulose acetate products and the percentage of total consumption going into each for the year 1949 is given here. The reader should note that this is cellulose acetate only.

Toys and novelties	20%
Communications (telephone, radio, and television	5%
Hardware (furniture, kitchen, tool parts, etc).	10%
Household	10%
Industrial	10%
Transportation (automotive, aircraft, bicycles)	5%
Personal (sun glasses, barrettes, buttons, combs, jewelry, cosmetic containers, etc.)	15%
Continuous extrusion (includes articles formed from extruded sections)	15%
Miscellaneous	10%

By and large, the acetate and butyrate producers expect to get a larger percentage of the injection molding material business than they did in 1948 and are confident that it won't be long before their poundage surpasses the record 1946 figure of 83,000,000 pounds.

Producers of acetate have no hope of ever approaching the polystyrene total poundage figure, since that material has captured many markets never fitted for acetate. Nevertheless, there is a belief the acetate situation will improve in both price and properties.

Acetate was hit almost immediately after the war with big price increases in basic raw materials. Alcohol and cotton linters, two formerly low cost materials, were out of all proportion to their pre-war costs when acetate was produced to sell at a low price. Acetic anhydride and acetic acid, other chemicals needed in processing, have likewise advanced far beyond pre-war costs.

The first reverse in this situation came in 1948 when cotton linters dropped below the former OPA ceiling price. Unfortunately, the rising cost in chemicals, labor, and overhead offset this reduction, but at least there were no advances in the selling price of cellulosics during the year as there were in most other materials. It is possible that costs of such potentially cheap materials as alcohol and wood pulp will again seek lower levels and thus help bring acetate to a closer price range with its chief rival, although possibly never to an even status.

But the acetate folks have another card that is now being played more often and which takes advantage of the scrap situation. One producer, for example, has a 35¢ material which is half scrap and half virgin material which is reworked and plasticized into a material that is highly satisfactory for many applications. Color range is limited to darker colors, but for most purposes it is adequate. The same company also sells a 30¢ material which is reworked scrap only. Reports have come from other sources that some companies have sold molding material from scrap at as low as 28¢. For such purposes as advertising novelties and many pre-war acetate applications, this lower priced material is satisfactory and particularly applicable since it has the toughness necessary for this type of application. One novelty molder says he has used almost nothing but this material since the end of the war.

There is no intent to imply in this article that scrap is the answer to the acetate industry's expansion problems, but only to suggest that it has its legitimate place. In the first place, the amount of scrap available is limited to 15% of the virgin material produced; in the second place, suitable applications are limited. The estimated use runs from 400,000 to 500,000 lb. a month, and only a part of it is recorded in the Government's consumption figures on which our acetate consumption chart (page 69) is based.

Another angle besides price that must always be considered in the future prospects for acetate is the possible improvement of the material by use of less costly ingredients or methods. Chemists have been working toward this end for several years, but no announcement of importance has been forthcoming.

Acetate is perhaps the easiest of all plastics to handle in a molding press, but in the softer flows it doesn't have the stability or, in general, the electrical properties of some of the other thermoplastics. Attempts to improve these properties are under way. Some producers are encouraging experimentation with other plasticizers than the now commonly used diethyl phthalate. They are in search of a plasticizer with lower cost and better availability than

Table V—Comparative Costs of Film and Papers Used in Packaging Industry.[a] (Comparative costs at typical prices based on approximately 1 mil films or basis weights as noted.)

	Per M sq. in.	*Per lb.*	*Yield*[b]	
	¢	¢		
Cellophane, plain	2.1	45	21,500	
" coated	2.4 to 3.0	47 to 59	19,500	
Acetate	3.5	75	21,700	
Pliofilm	3.8	92	24,000	
Polyethylene	2.7	85	30,000	
Saran	4.1	67	16,300	
Glassine, lacquered	2.3	36	15,500	28 lb.
" waxed	1.7	24	14,000	31 lb.
Sulphite waxed	1.2	20	16,500	26 lb.
Kraft paper	1.25	9	7,200	60 lb.

[a]Data prepared by Charles Southwick for lecture given before Package Development and Production class at New York University.
[b]Yield in sq. in. per lb.

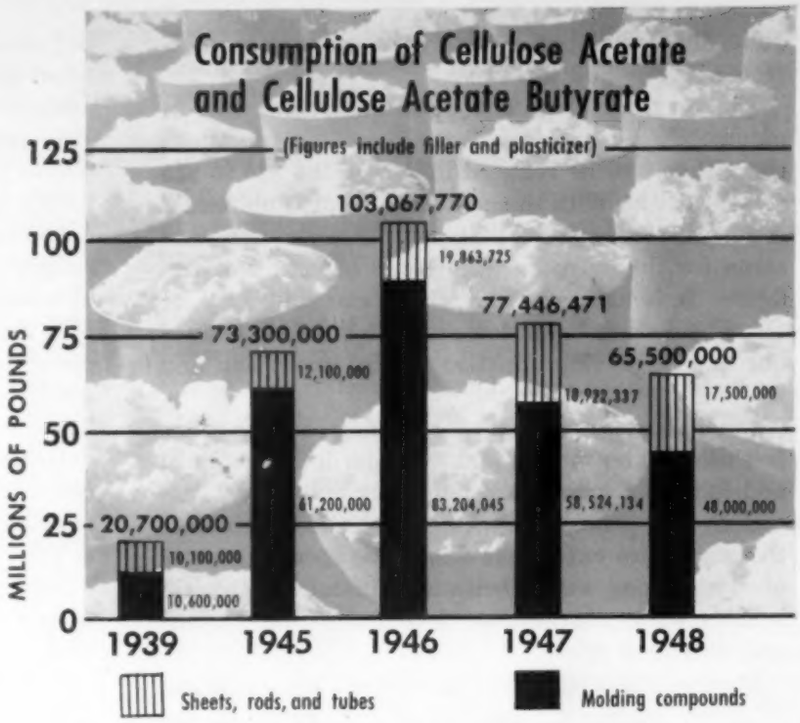
phthalates, which are dependent on the uncertain naphthalene production. Cellulose acetate butyrate is a form that does not require diethyl phthalate, but the researchers are hopeful of finding another acetate compound at lower or at least no higher cost than cellulose acetate.

Film and sheeting: Probably the decline or standstill in film and sheeting as shown in the government reports was more disappointing to the cellulosics industry than the decline in molding material. It is probably explained by the accident which incapacitated a principal producer's plant early in the year, but still there has not been the expansion expected in this branch of the industry. Perhaps 1949 will be the year for it to move ahead.

There are many straws in the wind to indicate a strong, upward movement for acetate film and sheeting in the future but, for one reason or another, those straws seem to keep on blowing every which way without ever settling down to point in a definite direction. Perhaps the straw pointing to lack of capacity will help determine the industry's real trend. A leading producer says that he could have sold twice as much thin gage material if it had been available late in 1948, but his capacity will be 50% greater in the first quarter of 1949. Certain it is that acetate film was difficult to buy in the last quarter of 1948. That is always a good period for film and sheet used in Christmas packaging, but the industry is hopeful that the last quarter upsurge will carry over into 1949.

Great hope was aroused a year or more ago for the future of sheeting over 0.0075 in. thick for use in boxes fabricated on automatic machines. The machines are around but no great volume of business is reported. The reason seems to be that orders of 100,000 boxes or more are necessary to make the machines economically practical, and orders of such size have not come along. Some observers believe consumption of that type of sheeting could be doubled or trebled if costs of production and fabrication could be reduced 25 or 30%, and it could be that improved methods will be aimed at that goal.

Thin film for food and other consumer goods has not progressed as expected any more than has the heavier material. It always looks promising, but the question of what kind of film will eventually be used for food packaging is far from settled. Growers and processors themselves have not determined what they want. They continue to experiment with all kinds of materials and probably won't decide until long periods of trial and error have elapsed.



Sheets, rods, and tubes include sheeting under and over 0.003 gage. The last three months of 1948 are estimated; other figures are based on monthly reports issued by the United States Census Bureau and United States Tariff Commission

Some idea of the size of this market is indicated by the present production of cellophane estimated at no less than 165,000,000 lb., with another company planning to come in. Fresh and frozen food packaging is now only a fraction of what it is expected to be in years to come. One important factor in the packaging competition is that each fresh food or fruit seems to behave differently when pre-packed, and each may require a different wrap. Tomatoes have been definitely ticketed for acetate. Developments are under way with asparagus, husked sweet corn, peaches, and strawberries in which it is claimed acetate is the most satisfactory material and will add several days to the life of the packaged material. The

(*Please turn to page* 140)

SARAN

SALES OF SARAN, VINYLidene chloride polymers, increased around 100% in 1948 over 1947, according to The Dow Chemical Co., producer. The company expects an even greater increase in 1949 and is planning to increase capacity, which has already been doubled six times since 1941.

Screen cloth, woven from saran monofilament, was reported to have taken from 30 to 40% of the total output. Volume of sales for the year ending

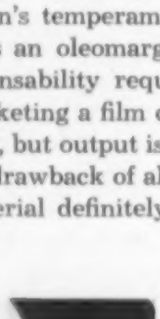
June, 1948, was approximately the same as the corresponding period for 1947.

The biggest percentage of saran growth was in automobile seat covers. Formerly in the premium class, they will be reduced in cost to the $20 to $25 range in 1949. With the competition cost differential removed, it is believed that the 1949 consumption of saran for this purpose will go far beyond the 1948 figure. It is estimated that there was only one set of seat covers in saran for every 10 in fabric in 1948 but that the 1949 production will be about half and half.

Extruded saran pipe is making slow, steady gains, but usage thus far is limited primarily to chemical and industrial plants and generally only when corrosion is a problem. Problems in molding and in the larger size extrusions due to the specific gravity of saran, along with fabricating difficulties, are still holding up any large-scale development for molded and extruded parts.

Products requiring the use of saran monofilament in rope, handbags, and shoes are quiet at the moment. The extra fine monofilament project by Saran Yarns Co. in Odenton, Md., is still in the developmental stage.

Development of saran film has been delayed by lack of proper packaging equipment, but that difficulty is soon to be overcome. Cheese processors in particular like saran for wrapping their product and are altering their packaging equipment to fit saran's temperament. There has been talk of using it as an oleomargarine package, but the degree of extensability required is not present. One firm is marketing a film containing saran for poultry wrapping, but output is still small. And perhaps the greatest drawback of all is premium price, which puts the material definitely in a specialty class.



POLYETHYLENE

A "SLEEPER" IN THE plastics industry may well be polyethylene, or polythene, as it is called by one producer. It has been held back because there was not enough material to supply demand. But the 17,000,000 or 18,000,000 lb. available in 1948 will probably be advanced to more than 50,000,000 lb. in 1949 if the Bakelite and Du Pont expanded facilities which were completed in 1948 are operated at normal rates.

The new production will provide an opportunity to expand the already well-established applications and allow more thorough testing of those products which have been held back for lack of material. The year 1949 may become the pivotal period which will determine the future for polyethylene. No one believes that expansion will stop at 50,000,000 lb.—users predict a near future annual production of several hundred million pounds, but no one is certain of just how far it will go in fields that are now barely served or in development.

A versatile material with some properties that eclipse other plastics, polyethylene has wide ranges of usefulness. It is potentially a low-cost material. Now around 50¢ a lb., there is a possibility that that price may some day be cut in half. Made from ethylene, a petroleum product, there is an abundance of low-cost raw material available. Manufacture under extremely high pressure at high temperatures is difficult and hazardous, but once know-how is established, production rolls along rapidly and efficiently.

Polyethylene can be extruded, molded, and some people say calendered, but no account of the latter on a commercial basis has been reported. Polyethylene is the lightest in weight of all plastics; it will float on water; electrical properties are superb; chemical resistance is high. In fact, the latter two properties are handicaps in some cases because of

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ACRYLICS

THE POUNDAGE OF acrylic in comparison to the total poundage for the entire plastics industry is small, yet acrylic is so popular and its uses are so spectacular that the trade names Plexiglas and Lucite perhaps symbolize "plastics" to the public more than any other coined names.

Acrylic production today is probably less than half of war-time consumption—when it was slightly over 30,000,000 lb.—but if present trends continue in functional and decorative use in buildings, as well as in large outdoor signs, the industry is headed for a prosperous future.

Acrylic molding material used primarily for automotive applications, high-style boxes and ornaments, brush backs, high grade costume jewelry, and similar "class" applications, probably totals less than 1,000,000 lb. a month. A new Elgin watch box illustrates the "class" category. The box looks more like a piece of jewelry than it does like a container. It is only the high price level that limits acrylic uses. If that price ever comes down to a competitive basis with other thermoplastics, there will be some interesting repercussions in the injection molding industry.

Molding powder prices were reduced in 1947 but

not enough to make acrylics comparable to other thermoplastics. Of greater interest, perhaps, was the Rohm & Haas announcement of a higher heat-resistant molding material which helped to broaden the range of present applications and make the material more satisfactory in many of its present locations—notably automotive. It has been reported Du Pont will announce a similar material sometime during 1949.

At least 50% of present usage is reported as being in automotive applications—horn buttons, escutcheons, radiator ornaments, stop light lenses. The stop light on a Cadillac, for example, requires 2/3 of a pound.

An interesting new molded application is in letters used by oil companies for signs for stations and trucks. One producer is molding letters that are ⅛ in. thick and vary from 6 to 15 in. in height. They can be molded at less cost than fabricated because of the quantity needed. The biggest letter reported uses around 12 oz. of material and is molded on a 16-oz. injection press.

The revived military aviation program got started last year with its resultant need for acrylic glazing, but the impact won't be felt much until 1949. Furthermore, changes in design have eliminated most of the acrylic enclosed blisters from bombers, and even though jet fighters require canopies, it is not believed that another war would require so much acrylic for aviation.

Large outdoor signs, biggest acrylic news in 1948, are now on test all over the country. The customary practice is for each customer to order a few and try them out. Consequently, tonnage is not large as yet and probably won't be for another year. But if big orders follow the tests, tonnage use will mount rapidly. An example is an oil company's sign now employing 75 sq. ft. of acrylic, including the facings on letters. The initial expense of fabricating and setting up an acrylic sign is more than that of a porcelain enameled sign of the same size with neon lighting, but the acrylic sign requires less maintenance cost—there are no tubes to break, and the light weight is important.

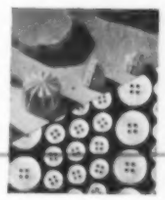
Corporations want time to study and test this new sign technique, but acrylic operators are confident that their advantages will become more apparent as time goes on, and they expect a large share of the sign business.

Another important outlet for signs is indoor displays made up of fluorescent acrylic, a material which gives striking effects when light strikes it. Any incident light produces a luminous glow either at the edge of the sign or where there is a cut into the surface.

Outdoor uses, such as domes on gasoline pumps in service stations and street lamp globes, are also on trial, but the latter in particular will be slow to reach volume production because municipalities are slow in ordering replacements and, although acrylic saves maintenance cost, the first cost is higher than common glass globes.

Architectural uses also take time to develop, but corrugated acrylic in particular is making headway for use in partitions, sky lights, and wall windows in industrial buildings. Store façades and lighting troffers are part of the picture.

Development of a thin extruded acrylic sheet is under way but not yet in volume production. One extruder has offered it in thicknesses from 0.015 to 0.060 inch. Extruded sheet is more brittle and doesn't have all the properties of cast sheet but it could, among other things, be stamped for watch crystals, converted into lenses by pressing thin sheets, and used for outdoor bulletin board covers.



UREA and MELAMINE

STATISTICS ON UREA AND melamine resins are inconclusive because of the complexities involved in reporting to government agencies who collect figures.

This is illustrated by the Tariff Commission report for 1947 which listed all types of solid resin urea and melamine sales as 105,000,000 pounds. Of this amount, 88,000,000 lb. were urea and 17,000,000 lb. melamine. The Census Dept. figures for 1947 as shown in Table I listed only 74,000,000 lb. identifiable as urea and melamine but did not include resin for molding powder nor protective coatings in that figure.

The urea and melamine total for 1948 as shown in Table I does not tell the story. Both laminating and molding powder figures are buried in the "Miscellaneous resins" at the bottom of the table.

Molding powder was unquestionably higher in 1948 than in 1947 when it was estimated near the 30,000,000 lb. mark—maybe a bit over or under. Estimates for 1948 vary but settle somewhere in the 40,000,000 to 45,000,000 lb. range, with the latter figure reckoned as extremely optimistic. Urea was still on allocation by the producers during a great part of 1948, but imports and increased domestic production of urea crystal from which the molding powder resin is made enabled producers to take advantage of their new plant capacities so that consumption moved upwards in the last half of the year.

Two new formulations were brought out by one producer during the year. One was a fast curing urea that would help cut costs because of shorter cycles, and the other was a low-cost compound in dark color only, but with splendid electrical properties. Neither has been out long enough to indicate

Plastics Engineering in 1948

by J. H. DuBois*

WITH the exception of polyethylene, which continues to be in short supply, there was a large gain during 1948 in the supply of molding compounds. Few people suffered for lack of materials despite numerous strikes. Deliveries improved considerably. The wide acceptance of polyethylene for bottles, films, and dishes is in part responsible for its scarcity.

From an engineering standpoint, 1948 stands out as a production year during which many previous engineering developments were expanded and consolidated as manufacturing gains. The trend towards automatic transfer molding of thermosetting materials, for example, has opened new low cost markets to these compounds.

Better diversification of markets and products will eliminate some of the volume fluctuations of 1948; wide diversification in numerous markets is essential to the maintenance of a reasonably smooth production schedule throughout the year.

It is noted that some of the larger consumers who have gone into molding their own products are reversing that trend since they are unable to obtain or maintain the skilled engineering staff that will enable them to operate economically. A highly skilled and experienced engineering staff can devise mold designs and production methods which will produce products at low costs that cannot be achieved by a contributing materials section in a manufacturing plant. Highly competitive market conditions have made the strong custom manufacturers efficient to the point where they offer large values unrealizable in an isolated operation.

It is probable that the metal shortages of 1949 will increase the demand for plastics although it is also possible that the same metal shortages will curtail the manufacture of numerous products and reduce many of the current markets. The larger values offered by plastics through improved manufacturing methods will continue to open markets which were previously unattractive. Increased labor rates in the woodworking and metal industries initiate gains for the plastics industry where our new methods and improved facilities permit the individual worker to turn out more goods per day.

The availability of metal is the principal unknown in the 1949 horizon. Plastics can gain and then can suffer from metal shortages. Since we are primarily manufacturers of contributing materials to all other industries, our index of activity will be measured directly by the general level of industrial activity. We expect 1949 to be a large volume year, highly competitive and much more stable than any previous post-war year. We have gone through the frustrations of material shortages, strikes, over production, high inventory, low inventory, lush profits, and no profit. Buying and production seem to have reached a sound economic stability that should minimize the excesses that have plagued us previously.

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how much influence it may have on urea sales, but both are intended to broaden the market.

The 1948 pattern for urea molded products did not show much change from former years. One of the first jobs since molding powder came into free supply has been to get back whatever end products may have been lost to other materials when urea was difficult to obtain. Radio cabinets, molded containers or boxes, and various types of housings should soon be appearing again in urea more frequently than in the past three or four years.

Buttons and closures now require an estimated 40% of the urea and melamine output, with buttons alone accounting for 25 percent. Such items as scales, business machines, instrument and clock housings, electrical apparatus, children's toys, dishware, and stove hardware seem firmly established in urea or melamine.

Probably the biggest news in melamine molding during 1948 was the increased popularity and sales of melamine dishware for both commercial and home use. There are a few complaints from users about various difficulties, but none of them seems without remedy. A cafeteria survey where the dishes had been on test for nine months reports a tableware replacement of 0.0013¢ per meal, or around $700 for that period, for melamine dishes, compared to a replacement cost of from $1500 to $1700 a year

on china. Many of the replacement losses on melamine were suffered when the dishes were carried off by customers!

A trade association for dishware was set up during the year to establish minimum standards of quality which recommend minimum and maximum cure, thickness, and finish.

Urea and melamine glues continue to increase and supplement vegetable, tapioca, animal, and other glues, not only because of quality, but because they are more stable in price. Primarily they are used for furniture and hardwood plywood in decorative applications, but a growing volume of urea household adhesives is in evidence. Melamine-urea glues are boil-proof, do not stain, and are processed at intermediate temperatures and pressures. Their weatherability seems proven by their increasing use in boat construction and in fabricating doors which are exposed to weather.

Use of melamine and urea in wet strength paper has increased at least 20% over 1947. Bags, toweling, blueprints, crate liners for vegetable shipping containers, and paper drapes are some of the chief outlets.

Melamine laminates increased for decorative purposes during 1948 and are due for further expansion when builders learn that the higher initial cost of laminated window sills, doors, trims, etc., is soon paid for by low maintenance cost. Television sets, furniture, and elevator cars are good volume potentials for laminates. In one factory as many as 1000 tables a day have been made with melamine laminated tops. The significance of the laminate was recognized last year when John D. Cochrane, Jr., a pioneer in its development, was awarded the top Hyatt award for achievement in plastics and a telephone booth constructed of melamine laminates won a MODERN PLASTICS Competition award.

Considerable interest was aroused last year over the possibility of using melamine resins with deciduous woods to produce paper pulp and thus make wider use of non-coniferous trees. However, commercial company technologists say that large-scale development of such a project will take some time to materialize.

Use of melamine in textiles for shrinkage control, water repellance, and wrinkle resistance, continued to advance—almost doubled in American Cyanamid Co., a leading producer, according to a firm representative. Shrinkage resistance in wools is presently limited to woven goods such as in shirts. A kindred application is in felt belts for paper mills where treated felt will last some 13 days in comparison to a former life of 7 days.

The wrinkle-resistant treatment for cottons in tropical weaves, cords, and seersuckers will be more in evidence next summer. The resin serves to hold the crease and expurge the wrinkles.

The resin treatment for water repellance in rayons, woolens, and cottons will be competitive with the cellulose-reactive treatment now common in raincoat fabrics. This new type resin can be combined with other resins to give the additional advantage of wrinkle resistance.

Two other interesting melamine textiles treatments include one that will give nylon marquisette net a permanent crispness or stiffness wanted in fabric designed for afternoon or party dresses. The other, a replacement of shellac as a hat stiffener, can be used on wool or felt to help prevent color fading.

NYLON

DEVELOPMENT OF NYLON as a more widely used injection molding material was held back several years by scarcity, price of $1.60 a lb., and lack of interest by molders who were busy with other things and thought they didn't have time to learn new techniques. But 1948 witnessed a revision of molders' opinions. Today there are at least 50 molders who can or have molded nylon products successfully. They have learned that the chief molding difficulty for the most widely used nylon compound can be eliminated by attaching a screen pack on the injector head to keep the material from running through like water when it gets above critical temperature. This very fluidity makes production of both large parts and tiny, complicated pieces comparatively easy.

The price differential is overcome when it can be shown that nylon parts will generally outwear almost any other material that can be used for the same job. Its toughness, heat resistance of over 275° F., and chemical resistance make it a favored material for hard duty. Since it can be lubricated with water, it is an ideal material for bearings, bushings, and gears. Rivets also have been successfully molded.

Molded nylon coil forms no more than 0.005 in. thick will withstand the tension of electrical wire wrappings and the heat used to bake an insulating varnish over the finished coil. Millions of coil forms are produced annually. They range in size from tiny ones that might be placed three on a thumbnail to some that are 4 in. in diameter. One molder is now selling them for less than other plastic forms. His economy comes from injection molding and a paucity of rejects—he can mold to minute tolerances.

Nylon dishware in use in state and government institutions can stand abuse and can be sterilized. Similar applications in restaurants and homes might

logically follow this development but has not as yet. Perhaps the fault is in merchandising. Price is not far from other high grade plastic dishware. Nylon tumblers, frequently seen on display counters and reduced in price last year from $1.00 to 59¢, were slow sellers. Perhaps a good system of labeling that would point out their durable and sterilizable qualities in comparison to other tumblers would help.

Combs and brush backs are other nylon molded products for consumers that are on the market but need promotion to overcome the price differential. A dollar comb is a slow mover unless its outstanding durability is emphasized. A hand brush for hospitals that can be repeatedly sterilized made a hit last year, but the big market for sterilizable brushes in barber shops has not been scratched.

Lack of color may be a handicap to movement of nylon molded products in consumer lines, but that will soon be remedied. Because it is so impervious to chemicals, nylon is difficult to pigmentize. It can be dip stained either in compound or on finished product, but that isn't always satisfactory. However, standard colors are now on the way and should ease former color problems.

Industrial moldings are becoming more common as molders learn the material's intricacies and the market for finished moldings. In the textile industry it has been found that nylon bushings, loom pickers, and thread guides are effective because of chemical resistance and because the thread doesn't wear grooves in them. Other applications such as hammer heads, valve seats, self-locking nuts, screw driver shafts, gaskets, washers, etc., are becoming standard applications. Hypodermic needle hubs, zippers, and arch supports are other typical nylon applications.

Nylon extruded over wire gives a tough jacket. An interesting variation is a thin nylon extrusion over steel cable. The nylon protective coating increases the number of times the cable can be flexed and saves half the cost of cable replacement. It gives corrosion resistance and smoothness so that the wire may be dragged easily over rough surfaces. For use in loading ships it prevents wire splinters from getting into the hands of stevedores.

Nylon monofilament for brushes, fishing leaders, sutures, tennis racket strings and even harp strings, is not quite equal to molding powder on a poundage basis, but is constantly growing. The market for all bristles, animal or synthetic, has grown rapidly. From 2,000,000 to 3,000,000 lb. of bristles were imported before the war and about 6,000,000 in 1947, according to one authority. Four million lb. are used for paint brushes in a year. Nylon bristles are now employed in about 10% of all master paint brushes. and since the reduction in price last year and the availability of shorter bristles for the first time, they are now available for amateurs' brushes.

Prices for professional 4-in. brushes now are $12.00 for hog bristle, $8.00 for nylon, and $3.00 for horse hair. The war forced painters to give up their prejudice against synthetic bristles so that the percentage in use is rapidly increasing.

Du Pont offers 4700 different types of nylon filament. Bristles for shaving and hair brushes range from 12 to 15 mils in diameter. Paint brushes use 12 mil tapered down to six. Ninety per cent of all hair brushes are claimed to be nylon bristled.

There are scores of odd shaped, big and little brushes used in industry which now have nylon bristles. The Chinese hog and the disappearing American horse have much less fear of losing their hair. Nylon, like many other plastics, is a utilitarian material that can fit into a multitude of places and take over the head man's place.

Machinery Survey

FIGURES are more eloquent than words in pointing up the increased capacity of plastics processors since the war. Since January 1946, 1735 compression presses, 2383 injection presses, and 625 extruders have been added to the industry's equipment in the United States.

The tabulation is as follows:

Type	*1946*	*1947*	*1948*	*Total*
Compression	910	490	335	1735
Injection	1555	350	478	2383
Extrusion	300	210	115	625

Of the 478 injection presses delivered in the United States in 1948, there were 128 of 2 oz. or less capacity, 230 ranging from 4 to 10 oz; 80 from 12 to 16 oz.; and 40 of 20 oz. or over. Of these 478 presses, about 338 were delivered to custom molders. In addition, not less than 214 injection machines were sold to foreign purchasers. Hand operated laboratory type machines are not included in these figures.

Of the approximately 335 compression presses sold in the U. S. in 1948 (exclusive of laboratory presses), between 170 and 185 were presses that exceeded 100 ton size. Rebuilt machines distributed by press manufacturers are excluded so far as is known. Slightly over 200 of all these domestically distributed machines were sold to custom molders.

The number sold to the foreign market is not known but was probably not much over 50.

A large number of compression presses were sold for the production of vinyl sound records and of large thermoplastic moldings such as toilet seats. Another interesting development was the purchase of a machine originally built for transfer molding of thermosets by the "tin can" method and which the purchaser is now using for molding a 9½-lb. thermoplastic battery case of polystyrene with practically unchanged techniques. The battery case is molded in one piece with a cycle of not much more than 5 min., and the molder states that this time will be materially reduced as operating experience is accumulated with this unusual type of machine.

The number of extruders from 1 to 6-in. size shipped to domestic users for plastics extrusion was in the neighborhood of 115. Slightly over 50 extruders were exported.

Table VI.—Estimated Number of Machines in the Plastics Molding and Extrusion Industry.[a]

Type	*1941*	*1945*	*1946*	*1947*	*1948*
Compression	8000	12,065	12,975	13,465[b]	13,800
Injection	1000	1720	3275	3625	4103
Extrusion		850	1150	1360[b]	1475

[a]Based on surveys by MODERN PLASTICS.
[b]Adjusted from preliminary report in January 1948.

Where Plastics Are Made

American Cyanamid Co. — Cyanamid's expansion insofar as plastics raw materials are concerned has been confined largely to the plant at Wallingford, Conn., where the over-all capacity has been increased five times from its war-time size. The company's capacity for urea and melamine molding powders, resin adhesives, textile treating, and laminating resins has been more than doubled since 1940. The Bound Brook, N. J., plant, where urea and melamine molding compounds are also produced, remains the same as it was in war-time. The Bridgeville, Pa., plant where polyester laminating resins, alkyds, and other surface coatings are produced has been expanded greatly. Capacity for polyester laminating resins has increased five times, for alkyds three times, and for other resins three times. Acrylonitrile, for which it is believed there will be considerable demand by the plastics industry in the future, is produced at Warners, N. J., and the company's plant there has a proposed annual capacity of 27,000,000 pounds. Phthalic anhydride is manufactured at the company's Bridgeville, Pa., plant. Dyes and chemicals for the plastics industry are produced by the Calco Chemical Div. of American Cyanamid Co. at Bound Brook, N. J., and other locations.

Net sales of the company in 1947 were $215,000,000, as compared with $179,000,000 in 1946. How much of this is plastics has never been designated, although it is believed to be an important factor in the company's sales.

The company has announced that its over-all expansion program, including plastics, since the war has cost over $70,000,000. American Cyanamid Co., in conjunction with the Texas Oil Co., has formed the Jefferson Chemical Co., Inc., which began operations in February, 1948, at Port Neches, Texas, where it is equipped to produce ethylene dichloride, ethylene oxide, and ethylene glycol from petroleum refinery gases. These chemicals, especially ethylene oxide, frequently find their way by indirect routes into the plastics industry.

American Molding Powder & Chemical Corp., has finished its expansion program for the production of polystyrene and cellulose acetate molding materials and is now supplying a complete range of crystal, transparent, translucent, and opaque cellulose acetate with a special formulation for extrusion purposes. A part of the expansion program included addition of a considerable amount of equipment for coloring polystyrene. All the company's manufacturing is done at one plant at 67 N. 9th St., Brooklyn, N. Y.

Bakelite Corp. reports that its plant production facilities continue to expand. During 1948 the average productive capacity of the corporation was increased 50 to 60 percent.

The new plant at Ottawa, Ill., went into production on a small scale early in 1948 and is now on a full production basis. This plant processes vinyl resins into plasticized film and rigid sheets, more than doubling the company's previous capacity for these products.

Production capacity of Vinylite resins was greatly increased at South Charleston, W. Va. The new Texas City, Texas, plant is in operation on a limited scale. Combined production of both plants, when operating at full capacity, will be more than double the early 1948 rate. The capacity for the production of Bakelite polyethylene resins at South Charleston will be increased by more than 100% by mid-1949.

Most of the plant expansion plans at Bound Brook, N. J., were completed during the year so that now

the facilities are increased about 30% for production of phenolic molding materials and other phenol formaldehyde products. Production of polystyrene has started at Bound Brook, and the expected 25,000,000 lb. annual production will be realized early in 1949. The new development building at Bound Brook was completed and is now occupied.

Construction of the new plant for Belleville, Ont., Can., which will produce phenolic plastics and resins and urea resin adhesives is underway, and it is hoped that it will be in full production by the end of 1949. Meanwhile, the Toronto, Ont., plant continues to produce the aforementioned products.

During the latter part of 1948, construction was started on a wood-flour plant, located at West Bath, Maine. This project should be completed about the middle of 1949. It is designed to produce only part of the company's expected requirements.

Location and products of plants of the Bakelite Corp., a unit of Union Carbide and Carbon Corp., are as follows: Bound Brook, N. J., Bakelite phenol formaldehyde, urea formaldehyde, polyethylene, polystyrene, and Vinylite plastics; Bloomfield, N. J., research and development laboratories, production of polystyrene materials; Ottawa, Ill., Vinylite plasticized film, rigid sheeting, and sheets; Monterrey, N. L., Mexico (Bakelite, D. F., Mexico), general-purpose phenolic molding materials, also serving as Mexican sales agent for all Bakelite products; Toronto Ont., Can. (Bakelite Co. (Canada) Ltd.), Bakelite phenolic plastics, resins, and urea resin adhesives.

The Borden Co., Chemical Div. — The year 1948 marked the creation of this new organization which took over the activities of the Casein Co. of America and Durite Plastics divisions.

The Casein Co. of America, an early producer of casein for paper coatings, cold water paints, and casein glues, was acquired by The Borden Co. in 1929. Durite Plastics, acquired by Borden's in 1947, is a leading producer of thermosetting synthetic resins, molding compounds, and varnishes.

Reporting on its plans for 1949, the Chemical Div. announces that it will increase its formaldehyde output by starting manufacture of that chemical in its Bainbridge, N. Y., adhesives plant. This will supplement the division's formaldehyde production at the

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Resin Statistics from Tariff Commission

THE difficulties involved in any attempt to fathom the mysteries of plastics production is illustrated by two sets of statistics published by the Government—one by the Census Bureau (see Table I, page 56) and the other by the Tariff Commission, reproduced in Tables VII and VIII, herewith. There are wide differences in some of the totals and explanations of those differences are not easy to give. Furthermore, the Tariff figures for 1947 were not released until October 1948. Consequently, it is impossible to compare 1948 figures. The situation may change in 1949 since lack of funds forced the Census Bureau to abandon its compilation, and the Tariff Commission has now taken over the monthly compilation of information such as that presented in Table I, page 56.

It will doubtless require several years to straighten out this situation since chemical statistics must necessarily be complex and involved because of the very nature of the business. There are variations in the forms used for reporting on a monthly and yearly basis, and companies themselves vary in their interpretations of what is required. No doubt there are also efforts made to mask certain figures so that competitors will not learn too much about each other's business.

As a further complicating factor, the Government does not permit publication of figures when the predominating amount of any one chemical is produced by only one or two companies—in such circumstances the figures are generally included in miscellaneous groups where they can be buried in a heterogenous collection of odds and ends. The Tariff Commission makes a claim that its annual figures are more nearly accurate than any monthly tabulation can be because errors and overlapping are much more likely to creep into a monthly statement than in a yearly statement. Adjustments can also be made in an annual report to allow for errors that may have turned up during the year.

The first great difference between the Tariff Commission's annual report, Tables VII and VIII, and the Census Bureau's report in Table I on page 56 is the grand total—1,251,699,000 lb. of synthetic resins produced and 1,134,739,000 lb. consumed in 1947. In Table I the consumption figure for plastics and cellulosics is given as 851,970,167 pounds. The difference

Table VII.—Production and Sales of Synthetic Resin Materials, Grouped According to Classes of Resins, 1947. (In terms of net resin content[a].) Source: U. S. Tariff Commission.

Chemical	*Production*	*Sales*[b]		
		Quantity	*Value*	*Unit value*
	1000 lb.	*1000 lb.*	*$1000*	*$ per lb.*
Rosin esters, total[c]	110,358	102,275	21,362	0.21
Unmodified	70,496	62,787	11,502	0.18
Modified, total	39,862	39,488	9,860	0.25
Those modified by phenolics[d]	32,078	32,270	7,609	0.24
Other modified rosin esters[e]	7,784	7,218	2,251	0.31
Rosin adducts: For protective coatings	5,267	4,031	1,194	0.30
Tar acid resins, except rosin ester modified, total	252,072	238,780	77,989	0.33
For adhesives[f]	31,870	31,387	7,832	0.25
For laminating	39,715	38,967	11,345	0.29
For molding and casting	115,475	111,577	41,103	0.37
For protective coatings	30,974	24,256	8,034	0.33
For treatment of textiles, paper, and leather	979	997	523	0.52
For other uses	33,059	31,596	9,152	0.29
Alkyd resins, oil and solid types, total	283,064	223,791	80,768	0.36
Phthalic anhydride type, total[g]	224,120	171,419	66,116	0.39
Unmodified	170,601	127,313	48,579	0.38
Modified, total	53,519	44,106	17,537	0.40
Those modified by rosin ester[h]	29,145	23,730	9,126	0.38
Except those modified by rosin ester	24,374	20,376	8,411	0.41
Alkyd resins, other than phthalic anhydride type, total[i]	58,944	52,372	14,652	0.28
Unmodified	12,227	11,045	4,637	0.42
Modified, total	46,717	41,327	10,015	0.24
Those modified by rosin ester[h]	45,541	40,440	9,741	0.24
Except those modified by rosin ester	1,176	887	274	0.31
Urea and melamine resins, total[j]	112,400	105,252	35,135	0.33
For adhesives	45,641	45,365	9,952	0.22
For treatment of textiles, paper, and leather	16,882	14,133	3,847	0.27
For other uses	49,877	45,754	21,336	0.47
Vinyl resins, total[k]	177,443	160,948	63,089	0.39
For glazing, sheeting, and film	54,560	52,839	21,323	0.40
For molding and casting	57,796	53,067	18,343	0.35
For treatment of textiles, paper, and leather	30,126	25,133	9,998	0.40
For other uses	34,961	29,909	13,425	0.45
Styrene resins[l]	105,867	98,903	26,648	0.27
All other plastics materials, total[m]	205,228	200,759	125,129	0.62
For molding and casting	19,154	17,202	10,121	0.59
For protective coatings	20,610	20,512	4,430	0.22
For other uses	165,464	163,045	110,578	0.68
GRAND TOTAL	1,251,699	1,134,739	431,314	0.38

[a]Net resin content excludes all fillers, unreacted modifiers (such as ester gum when not chemically combined), dyes, and plasticizers. Additives such as rosin (80% or more abietic acid) which are chemically combined with other resin-forming components are included in the data.

[b]Sales of resins for protective coatings include certain intraplant transfers as well as the usual interplant transfers, i.e., transfers from one establishment or the department of the company synthesizing resins for surface coatings to the establishment or department of the same company which uses them in the formulation of protective coatings.

[c]Includes esters of tall oil.

[d]Phenolic resins modified with rosin (unesterified abietic acid) are included with tar acid resins.

[e]Includes rosin esters, modified by fatty acids or oils. Other modified rosin ester resins are included with alkyd resins.

[f]Includes small amount of coumarone-indene resins.

[g]Oil type phthalic alkyd resins for protective coatings accounted for 99% of all phthalic alkyd resins. Production of solid type phthalic alkyd resins for other uses totaled 1.7 million pounds.

[h]Alkyd resins modified by rosin are classified with rosin ester modified resins because of radical interchange. Data are included for resins which are modified with phenolics, and fatty or dibasic acids in addition to rosin. Tall oil modifications are also included.

[i]Includes alkyd resins made from cyclopentadiene and maleic, fumaric, adipic, azelaic, citric, sebacic and other dibasic acids. Production of solid type resins accounted for 75% of all alkyd resins other than the phthalic type.

[j]Includes substituted urea and melamine resins, and modifications.

[k]Includes polyvinyl halides and copolymers, butyral, and formal and acetate, alcohol, and ethers.

[l]Includes modified and unmodified styrene polymerization and condensation resins.

[m]Includes acrylates, aniline-formaldehyde, coumarone-indene, furfuryl-furfural, petroleum resins, polyamide resins (nylon), polyethylene, polyterpene, silicones, and other miscellaneous resins.

is largely accounted for in cellulosics and protective coating resins. The latter are not included in Table I, and cellulosics are not included in Table VII. Resins for protective coatings, which totaled over 450,000,000 lb., or over 36% of the total resins produced in 1947, are for the paint, varnish, and lacquer industry, which is not generally considered as a part of the plastics industry. Of this total, alkyd resins comprised some 283,000,000 pounds. This is, incidentally, the greatest production of any single synthetic resin. It compares with an alkyd resin total production in 1946 of 245,000,000 pounds. Protective coating resins of all types totaled 380,000,000 lb. in 1946, or 38.2% of all synthetic resins.

If the protective coating resins were deducted from the total of all synthetic resins and the 90,000,000 lb. of cellulosics added to what remained, the amount of resins and cellulosics used for plastics, adhesives, and "miscellaneous" in 1947 would be around 900,000,000 lb., according to the Tariff Commission annual figures, and would compare with a near 850,000,000 lb., according to the Census Bureau's monthly figures. Coumarone indene and a few miscellaneous resins probably account for the difference.

The money value given with these tables is also a questionable figure to use as an all-over sales figure for the synthetic resin industry because it includes a great deal of intra-company exchange; that is, the producing company uses the resin in its own business to make some other product, and such exchanges are subject to considerable bookkeeping technique that is hardly comparable to outright sales to the public.

There are other differences which the reader can find if he cares to examine both tables, and these differences indicate that the plastics industry statistics are in need of coordination.

Table VIII.—Production and Sales of Synthetic Resins Grouped According to Use, 1947. (Quantities and values are based on net resin content only.) Source: U. S. Tariff Commission.

Material	*Production*		*Sales*				
	Quantity	*% of total*	*Quantity*		*Value*		*Unit value*
			1000 lb.	*% of total*	*$1000*	*% of total*	
	1000 lb.						*$ per lb.*
Plastics materials, benzenoid and nonbenzenoid							
For protective coatings	453,006	36.2	378,709	33.5	124,423	28.8	0.33
For molding and casting	312,737	25.0	295,335	26.0	105,633	24.5	0.36
For laminating	45,865	3.7	44,766	3.9	14,327	3.3	0.32
For adhesives	98,346	7.9	93,589	8.2	24,848	5.8	0.27
For treatment of textiles, paper, and leather	54,251	4.3	45,660	4.0	17,908	4.2	0.39
For ion exchange	7,874	0.6	6,730	0.6	1,705	0.4	0.25
For miscellaneous uses	279,620	22.3	269,950	23.8	142,470	33.0	0.53
TOTAL	1,251,699	100.0	1,134,739	100.0	431,314	100.0	0.38
Plastics materials, benzenoid							
For protective coatings	302,941	41.1	243,722	36.8	83,122	44.0	0.34
For molding and casting	207,243	28.1	196,303	29.7	65,225	34.6	0.33
For laminating	40,785	5.5	39,908	6.0	11,767	6.2	0.29
For adhesives	31,870	4.3	31,387	4.7	7,832	4.2	0.25
For miscellaneous uses[a]	154,875	21.0	150,964	22.8	20,742	11.0	0.14
TOTAL	737,714	100.0	662,284	100.0	188,688	100.0	0.28
Plastics materials, nonbenzenoid							
For protective coatings	150,065	29.2	134,987	28.6	41,301	17.0	0.31
For molding and casting	105,494	20.5	99,032	21.0	40,408	16.7	0.41
For laminating	5,080	1.0	4,858	1.0	2,560	1.1	0.53
For adhesives	66,476	12.9	62,202	13.2	17,016	7.0	0.27
For miscellaneous uses[a]	186,870	36.4	171,376	36.2	141,341	58.2	0.82
TOTAL	513,985	100.0	472,455	100.0	242,626	100.0	0.51

[a]Includes plastics materials for ion exchange; glazing, sheeting, and film; and for treatment of textiles, paper, and leather.

The Economics of Extrusion

Second of a series of three articles which examine the economic factors in plastics extrusion, point up trends in application, expose possible pitfalls in the business, and encourage a sound approach to problems involving materials and methods

(Continued from last month)

EARLIEST products of plastics extrusion, except for tubing and rod, were rigid strips with various profiles for use in assembling panels or sheets of glass in display cases and as nosings, edgings, and similar trim for commercial furniture. From those early profiles came the whole present-day group of industrial profiles, made successful through improved formulation, design, and extrusion.

Refrigerator breaker strips against which the deep doors rest when closed are good examples of modern profiles. They are generally designed to be clipped into position on the assembly line; the materials most frequently used are ethyl cellulose and cellulose acetate butyrate—both tough and quite stable. Several extruders have concentrated a lot of effort in this field. Sandee Mfg. Co., Chicago, Ill.; Hopp Plastics, New York, N. Y.; Detroit Macoid Corp., Detroit, Mich.; and others are now producing breaker strip profiles. Of the 5,000,000 refrigerators produced in 1948, more than 1,000,000 were fitted with these extrusions, and it is expected that fully half of the refrigerators made in 1949 will be so equipped. Reports reaching MODERN PLASTICS indicate that higher impact formulations of polystyrene are now being considered for this use.

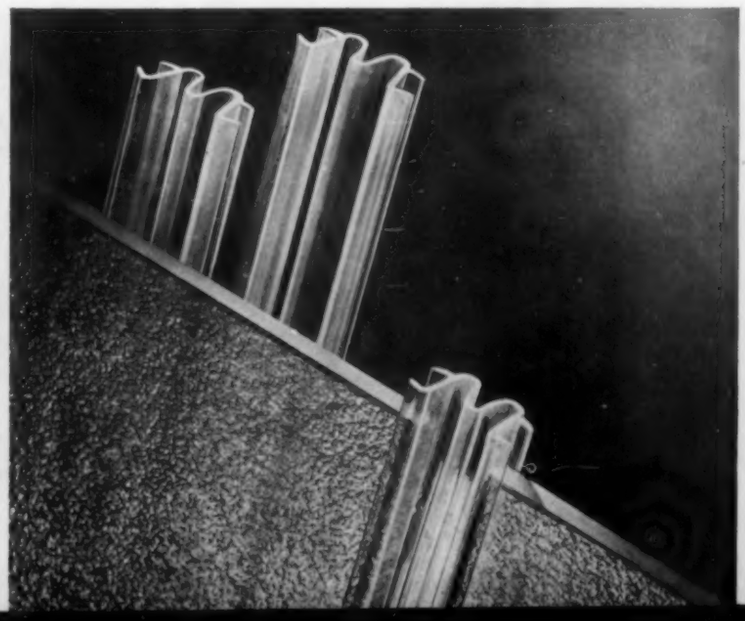
In the past two years the fluorescent lighting field has become a fair-sized market for extruded polystyrene light shields. Such companies as Sandee; Plastex Corp., Columbus, Ohio; Plastic Process Co., Inc., Los Angeles, Calif., Hopp Plastics; Extruders, Inc., Culver City, Calif.; and Superior Plastics Div., Commonwealth Plastics Co., Chicago, Ill., have made a big and constantly expanding business out of it, establishing illumination as a top-notch field for extrusion.

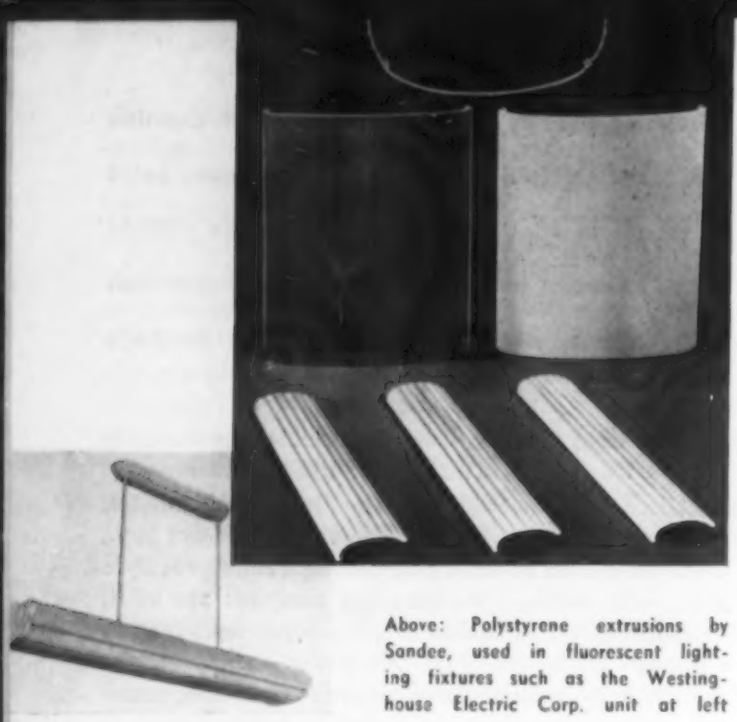
As high heat resistant polystyrenes becomes better known and more available, this market is bound to increase. Polystyrene allows a light transmission of 92% or more; in properly designed cross-section it is non-shattering; its retention of color and dimension is well-nigh perfect; its light weight in large pieces is important in overhead fixtures and in shipping. Vinylite compound is also being extruded, with low die temperatures, by Southern Plastics Co., Inc., Columbia, S. C., to make light diffusion shields for the Benjamin Electric Mfg. Co., Des Plaines, Ill. The plastics sections do not compete on a straight price basis with acid-etched glass but compete easily with enameled or pigmented glass. Fluorescent diffuser strips up to 19 in. in width are now being extruded. A new market reported by Extruders, Inc., is in theater marquees.

In producing breaker strip and fluorescent lighting profiles, successful custom extruders have built their business on the basis of sound engineering and

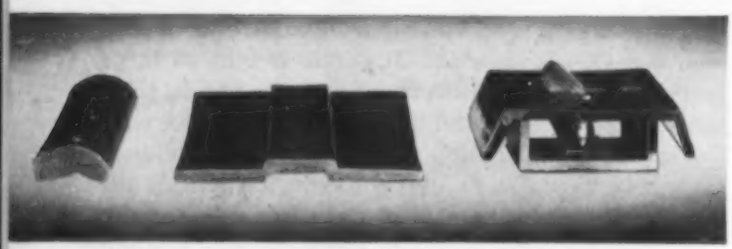
Translucent glass panels on this Otis escalator are joined by extruded butyrate strips, as at right. The strips compensate for slight variations in dimensions of the panels; their smooth surfaces protect passengers

PHOTOS COURTESY TENNESSEE EASTMAN CORP.





Above: Polystyrene extrusions by Sandee, used in fluorescent lighting fixtures such as the Westinghouse Electric Corp. unit at left



Telephone control switch (right, above) uses three extruded acetate parts — face plate, toggle cut from section at left, and pressure bar cut from section in center. Bar is seen from the end in view of complete switch. Switch is produced by World Plastex, Inc.

Price ticket holders are made from sections of rigid extruded profiles. Tickets are laminated thermoplastic

quality cross-sections, even to the extent of refusing to make walls too thin or to use material about the properties of which they are uncertain. The better engineered jobs which result from research and study by the extruder must command a conversion price of not less than two to one over material costs. No extruder can give these fields adequate engineering service at a lower mark-up. Price cutting in this field would be disasterous.

Rigid extruded profiles used for price ticket channeling in super markets are being produced on a proprietary basis by Hopp Press, Inc., and others. They represent a market only if sold as a service along with printed laminated thermoplastic price tickets and other related retail equipment. On this basis of combination sale the market has proved profitable for a very few extruders. On a custom basis it is doubtful whether an extruder can make money at it.

Speciality profiles for architectural uses are proving to be good business for careful extruders. An example is the job done by Hopp Plastics, in Tenite II cellulose acetate butyrate, on the joining strips used to separate and protect illuminated glass balustrade panels in the new Otis escalators. The pleat-type extrusion is resilient enough to accommodate the panels and hold them in position, yet has sufficient light transmission to be attractive.

Post-formable rigid tubing

Related to the rigid profiles is post-formable rigid tubing, pioneered by Yardley Plastics Co., Columbus, Ohio, in collaboration with Dow Chemical Co., in wands for the new Kirby vacuum cleaner made by Scott & Fetzer, Cleveland, Ohio. A special formulation of ethyl cellulose developed for this extrusion job has proved so tough that no amount of abuse will mar, chip, or peel the parts. The tubing is extruded and post formed by Yardley, the swedging and tapering operation being done on dies with special tools.

Post-formed irrigation tubes made from butyrate have been marketed by Carter Products Corp., Cleveland, Ohio, for some years and are now a staple item.

A large but rather specialized and slow-growing field for extrusion is one which at first glance seems obvious: the field of plastic pipe. Some companies, Extruded Plastics, Inc., Norwalk, Conn., among them, have made a specialty of selling a standard stock line of tubing and almost every extruder in the country has at one time or another extruded plastic pipe. Almost every architect in the country has had hopes for plastic plumbing. From this wide experience and from these hopes have come some applications important enough to justify the manufacture of standard lines of plastic pipe.

Elmer E. Mills Corp., Chicago, Ill., has been in production on saran piping for several years. Mills injection molds saran pipe fittings to be used with its

extruded pipe and has sold extensively to chemical plants manufacturing medicinals. A recent installation is for piping hydrogen peroxide in the Parke-Davis factory in Detroit, Mich. The extrusion of saran is a specialized production job.

A new pipe called "Extrulite," made from modified styrene, was recently announced by Extruders, Inc. It is resistant to chemicals, gas, concentrated acids (except oxidizing), and alkalies. In its ½-in. inside diameter size it will take working pressures up to 650 p.s.i. and, at a price comparable to that of steel pipe, it is being used for underground installations by gas companies, for chemical plant work, and for sprinkler systems.

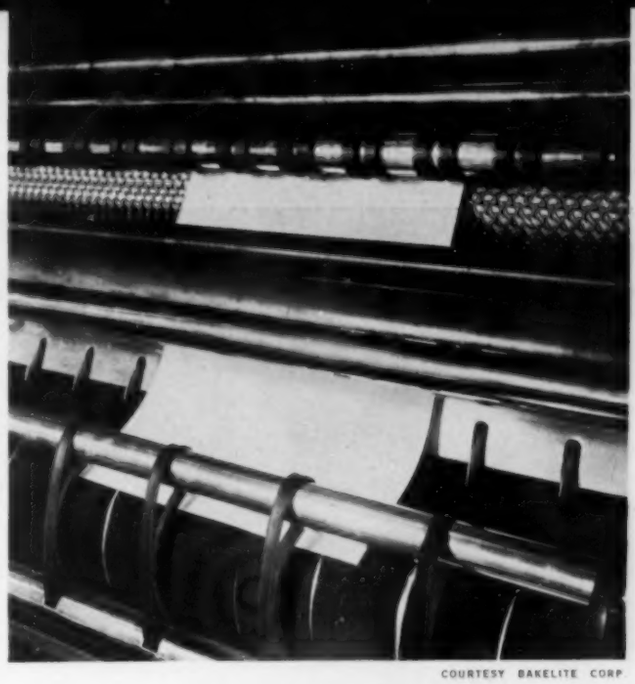
Carter Products Corp. is a big extruder of specialty pipe. One type, made of polyethylene by Carter, is 3 in. in diameter, has a 0.150 in. thickness, and is used to pump water containing sulfur out of mines. Metal pipes formerly used quickly corroded; polyethylene has passed every test. Polyethylene tube in smaller sizes is extruded by Anesite Co., Chicago, Ill., for carrying hot nitric acid in atomic energy plants. Another application is in gas furnace chimneys, where the tubing is used to carry off condensate containing sulfuric acid.

As far as the above-mentioned "semi-standard" pipes are concerned, it is obvious that applications must be sold on an engineering basis. Nobody is going to replace metal pipe of any kind with plastic pipe as long as the metal pipe is available, is inexpensive, and will do the job as well. In every case the plastic pipe is sold to serve a special purpose.

Flexible tubing

Small flexible tubing of vinyl, polyethylene, and some copolymers is a special proposition but is becoming more standard as applications are proved in use. Very small polyethylene tubing has been a speciality of Jessal Plastics, Inc., Hartford, Conn., and Anchor Plastics Co., Inc., New York, N. Y., for the medical profession. It is used to drain blood off the heart, to tap abscesses, and even to replace human tissue. Recently the need for specialized medical tubing has increased and Jessal's latest is a small extrusion with one hole in the center and three in the walls, used to control bleeding ulcers at the entrance and exit of the stomach, a condition which formerly resulted in 90% fatality. The perfection of such medical tubing has been a three-year job for those who have been successful in making it to the specifications of the doctors. Reported to be profitable within its range, it is definitely not a market for companies who do not intend to engage in the necessary research.

The third and final article of this series, to appear in our February issue, will cover extruded rods, proprietary products, monofilaments, multi-colored extrusions, and future possibilities.



COURTESY BAKELITE CORP

Hairline grooves in the extruded vinyl applicator rolls of this Bruning blue-print machine distribute developer

COURTESY THE DOW CHEMICAL CO.

A special formulation of ethyl cellulose is used in extruding post-formed, light weight vacuum cleaner tools

Newly developed is a method of extruding circular channels of rigid thermoplastics, without buckled edges

COURTESY ANCHOR PLASTICS CO., INC.

MULTIPLE-USE

COLOR PLATES COURTESY TENNESSEE EASTMAN CORP.

Colorful, safe, all-plastic crib toy has phenolic, butyrate, and vinyl parts

TOY COMPONENTS

many of them extruded, help cut tooling costs

for new line of sturdy all-plastic toys

AN unusual number of extruded parts are used in the group of Play-Safe toys recently introduced by Sandee Mfg. Co., Chicago, Ill. Of equal importance is the fact that many of the parts used in assembling the toys are so designed that they can be used in a number of different ways in various items in the line.

Included in the Play-Safe group are crib exercisers, push-toys and pull-toys for toddlers, and toy sporting equipment (golf, croquet, and quoits) for slightly older children. Cellulose acetate butyrate, vinyl, and cast phenolic are the plastic materials used.

The use of Tenite II cellulose acetate butyrate for all the main parts of the toys gives them sufficient impact strength to take the rough handling which they are likely to get from high-spirited toddlers. The plastic also makes the toys colorful and insures the durability of that color. The Catalin and Vinylite parts are equally as colorful. Thus the toys can be assembled from bright red, yellow, green, blue, and gleaming white parts—all of which are washable, chip-proof, and virtually unbreakable.

The use of interchangeable parts in the various items in the line cuts down the costs of molds and dies. It also gives the various items in the line a family resemblance which can be a valuable asset in selling additional toys to consumers who have bought one item in the line and have been satisfied with its performance.

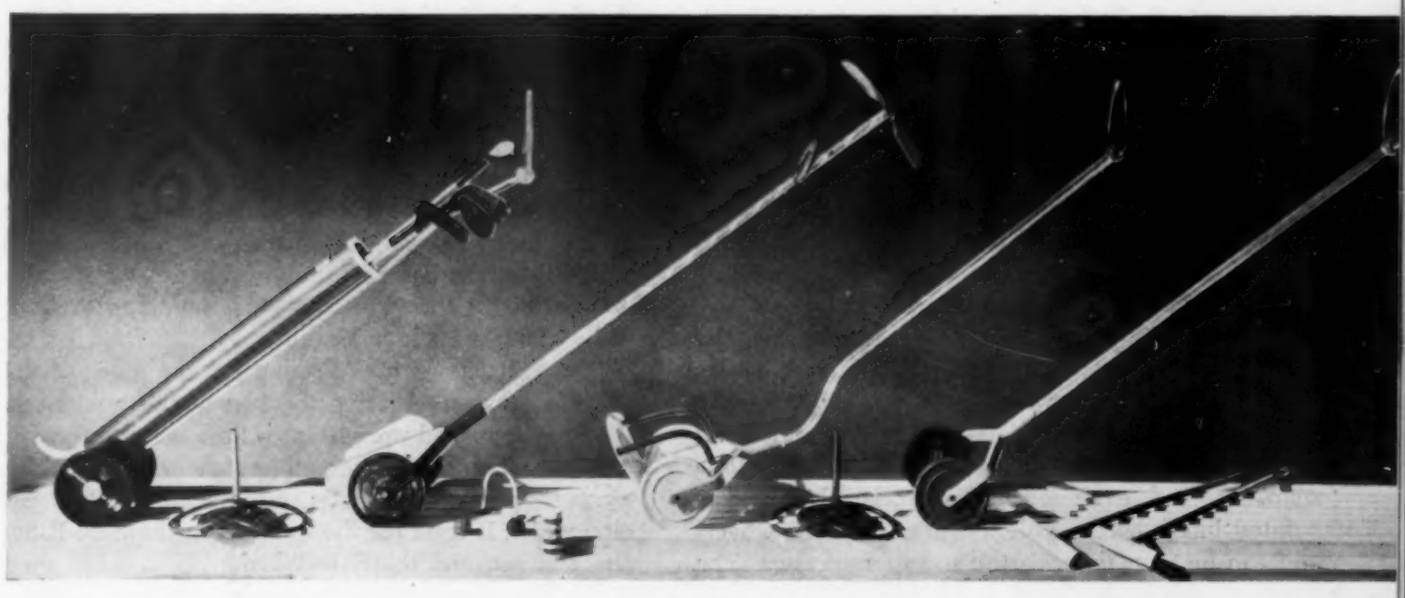
This family resemblance is further strengthened by the packaging and labeling. All of the toys are packaged in similar blue and white boxes, and boxes bear the manufacturer's trade mark—a drawing of a kilted bagpipe player. The use of the word "Safe" in the trade name for each toy also helps in merchandising.

Toy mower

The Play-Safe line developed gradually from one item which was originally made to replace a broken wooden toy for a daughter of one of the company's executives. The first item was a lawn mower-like push-toy which Sandee calls the Safe-Whirl. It is a simple toy which consists of two molded Tenite II wheels with diagonally placed extruded transparent Tenite II tubes between them. The exterior of the tubes is round, but the inside wall is hexagonal, thus providing facets which catch and reflect light. Colorful Catalin balls in the transparent tubes roll from side to side and click against each other as the toy is rolled.

The stem of the toy is either a piece of the same hollow transparent Tenite II extrusion or a solid rod, either transparent or opaque. The stem is cemented to a molded Tenite II yoke which snap fits over the ends of an extruded butyrate rod that serves as an axle. The circular handle, a vinyl extrusion, is cemented in holes drilled in another Cata-

Molded wheels and yokes, plus a number of extruded parts, serve many uses in the line of toys shown below. Note how wheels, for example, are used as bases for quoits pins



Above, left: Toy bomber has friction gear of butyrate and rubber. Above, right: Parts used in line of toys include bomber tail section and fin, stem, yoke, seat, arms, wheels, and balls

lin ball which, in turn, is cemented to the stem.

The entire bottom assembly of the Safe-Whirl is used in another item in the Sandee line, the Junior Safe-Spin. The same wheels, diagonal tubes, and Catalin balls are suspended on a vinyl extrusion from the rails of a crib or play pen. The only additional parts are some colored Catalin beads strung on a vinyl extrusion on either side of the revolving part of the toy. A larger, "de luxe" version of the Safe-Spin is shown in color on page 82.

The same wheels, axle, yoke, and stem pieces as those used in the Safe-Whirl are used in two other items in the Play-Safe line: the Safe-Ride, and the Safe-Flight. The former is a rickshaw-like doll stroller, the seat of which is formed from extruded butyrate sheet. The arms, extruded butyrate rods, are put through holes in the seat and seat back. The rod ends are then mushroomed to hold the arms.

A propeller that turns

The Safe-Flight, which resembles an airplane sufficiently to satisfy an imaginative youngster, is designed so that the child can "ride" it by straddling it and dragging it with him as he walks.

The wheels are cemented to the axle so that the axle rotates. A plastic gear is cemented to the center of the axle. This gear engages a rubber disk (the only non-plastic part in the assembly) which is fixed to the end of a rod which goes through the hollow stem. The rod, extruded of Tenite, is white and is painted like a barber pole. It turns with the wheels and can be seen through the transparent stem. The propeller, cut from extruded butyrate sheet, is cemented to the top of the rod, and thus turns with it.

The "tail section" of the plane (the part between the two wheels) consists of two parts. The main (or horizontal) part is formed from extruded Tenite II sheet. The vertical piece is molded of elastomeric vinyl.

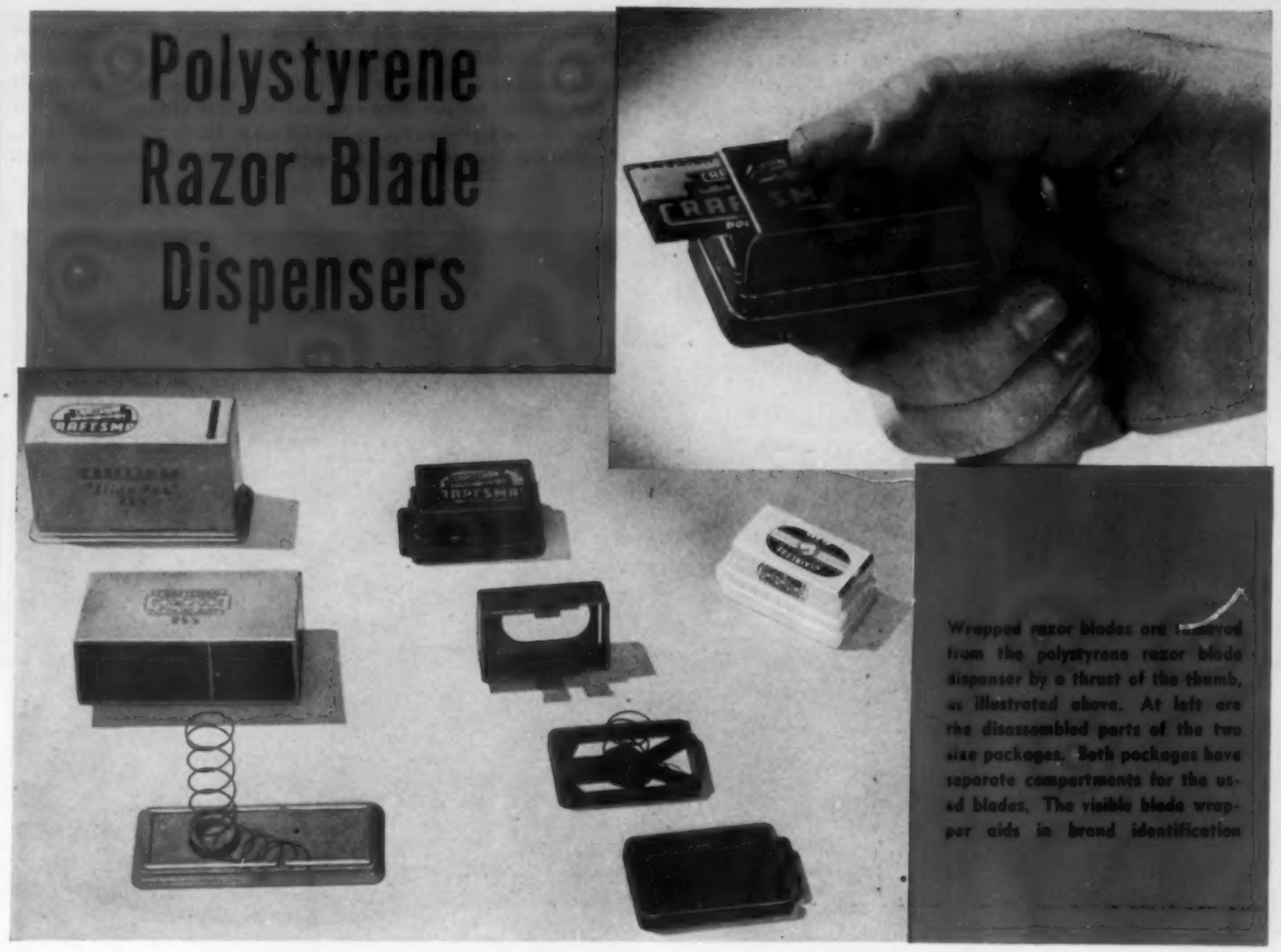
Golf, croquet, and quoits

The now familiar molded Tenite II wheels appear again in the Safe-Golf toy, a golf bag on wheels complete with four clubs and a harmless cotton "golf ball." The set of clubs consists of a "wood," two "irons," and a putter—all with molded Tenite II heads and extruded shafts of the same material. The main shaft of the golf bag cart is a solid Tenite II rod. The bottom of the bag, which has a foot to hold the bag in an upright position, is molded of butyrate.

The croquet set makes use of a number of parts used in the other toys in the line. The shafts of the croquet mallets are the same as the shafts of the golf clubs. The wickets consists of round butyrate extrusions; the bases of the wickets are the Catalin balls used in the Safe-Spin crib toy. The croquet balls are also made of Catalin.

The extrusion which is used for the axles of the wheeled toys also forms the peg in the quoits set. The peg is placed upright on a base which is one of the wheels used in all the other toys in the line. The rings themselves are made of the same vinyl extrusion which is used for the handles on the Safe-Ride, the golf set, and the Safe-Whirl.

Polystyrene Razor Blade Dispensers



Wrapped razor blades are removed from the polystyrene razor blade dispenser by a thrust of the thumb, as illustrated above. At left are the disassembled parts of the two size packages. Both packages have separate compartments for the used blades. The visible blade wrapper aids in brand identification

TWO new polystyrene dispenser type packages for razor blades have been introduced by the Vulcan Safety Razor Corp., Maplewood, N. J. The new packages, called Slide Paks, are designed to hold razor blades wrapped in paper to prevent rust and to protect their edges. The Slide Paks also contain used blade compartments, an innovation in plastic blade packages.

The wrapped blades in the Slide Pak are held firmly in place against the top of the package by a coil spring. The top blade is visible through an oval opening in the package and can be easily removed through a slot in the side of the package by a thrust of the thumb. The fact that the wrapper is visible aids in brand identification. The brand name is also hot-stamped on the side of the dispenser.

Two types of dispenser

Vulcan's smaller Slide Pak can be used to hold any number of blades from 5 to 15. It consists of three plastic parts: 1) the top section, or blade compartment; 2) the bottom section, or used blade compartment; and 3) a middle piece which separates the two compartments and holds the coil spring which keeps the wrapped blades in place.

The blades are inserted in the top section of the dispenser before assembly. The other two parts are then joined to the top by a snap-fit. Two lugs on the top section pass through openings in the center piece and engage slots in the bottom piece.

Large dispenser holds 50 blades

The larger dispenser is so constructed that it will hold up to 50 blades, although it is usually used for 25 blades. This version of the package is molded in two parts. The top piece has a partition molded into it to separate the wrapped blades from the used blade compartment. The bottom piece, which holds the spring, is cemented to the top with a fast-bonding glue after the blades have been inserted.

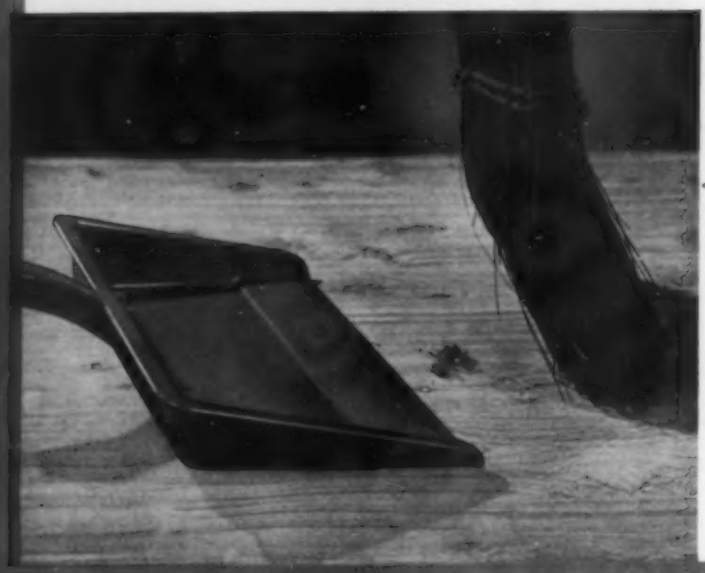
The polystyrene parts for both dispensers are molded for Vulcan by the Plastene Corp., Crawfordsville, Ind.

Vulcan uses the Slide Paks to merchandise its own brand of carbon steel blades and two brands of stainless steel blades. In addition to the brand name hot-stamped on the package and the distinguishing paper wrappers used, Vulcan uses different color dispensers (blue, grey, and ivory) to differentiate between the brands. Vulcan also supplies blades and differently colored dispensers to various specialty shops who use private brand names.

PLASTICS

Measuring 2½ by ⅝ in., and weighing only 2.6 oz., this miniature radio pillow speaker enables a person to listen to a radio program without annoying others near him. It is recommended for hospitals, hotels, public conveyances, and the home. Produced by Telex, Inc., Telex Park, Minneapolis, Minn., the speaker has a molded polystyrene bobbin and a melamine face

A housewife doesn't have to bend over and hold this plastic dustpan steady. Short legs on the back of the pan do the job for her. A dust-catching groove to prevent dirt from sliding out and a specially designed lip that fits snugly against the floor and prevents a dust line are also features. Rogers Plastics Corp., North Wilbraham, Mass., molds the dustpan of Lustrex polystyrene in red, green, or black

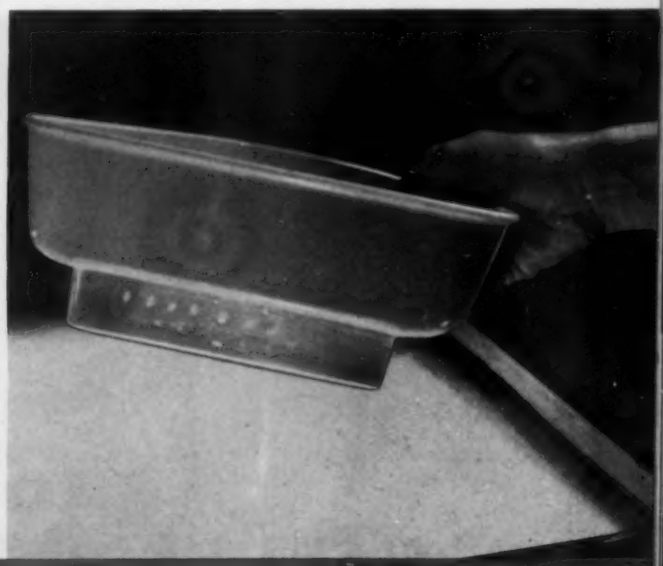


A new way of expressing old familiar greetings is provided with these clever new holiday card records. The sound track is impressed on a clear Lumarith cellulose acetate disk placed over colorfully printed paperboard. It has a playing time of 1 min., and can be replayed up to 200 times. Produced by Plaxall, Inc., 132-33 40th Rd., Flushing, N. Y., these musical cards are light weight for easy mailing

Measuring cups molded of Tenite II cellulose acetate butyrate in pastel colors and lined at the bottom with stainless steel have been especially designed for the witWhip, a mixer which requires only one hand to operate. Manufactured by Dr. JoWit Laboratories, 2019-29 Broadway, Santa Monica, Calif., the cups come in pint and quart sizes. The mixer handle is also molded of butyrate in colors to match the cups

Innersoles woven of Lumite plastic ventilate the inside of shoes and are said to avert many foot ills such as callouses, blisters, athlete's foot, etc. The manufacturer, Dale-Vent-O-Sole, Inc., 52 Vanderbilt Ave., New York, N. Y., uses five layers of the plastic material to provide a cushioned effect. The innersoles come in a wide range of sizes, are flexible, washable, do not absorb odors, and can be washed with soap and water

Those who have dashed from sink to garbage can between drips will have no more such trouble with this new sink strainer which has an extra compartment under the strainer section to catch drippings. Molded in one piece of Lustrex LX and manufactured by All Power Mfg. Co., 202 Roosevelt Ave., Montebello, Calif., it comes in red, blue, yellow, and white



S PRODUCTS

Artists will find this efficiently designed paint tray, which is marketed and distributed by M. Grumbacher, Inc., 460 W. 34th St., New York, N. Y., a great help in their work — whether it's a landscape, portrait, cover girl, or caricature. The tray is molded from Beetle urea formaldehyde. Cleaning is a simple matter and individual colors are kept separated. If more than one tray is required, they can be stacked on top of each other to keep the paint dust free until needed again

A poultry wing marker which is said to be far more visible, less costly, and easier to apply than sealed leg bands has been introduced by Dryden Poultry Breeding Farm, Modesto, Calif. The inch-high transparent holder is molded of Tenite II cellulose acetate butyrate by Precision Mfg. Co., 50 Brady St., San Francisco

Light weight, all purpose, flexible mitts fabricated of transparent Vinylite plastic allow a housewife to tackle a sinkful of dirty dishes without roughening her hands or marring a new nail polish job. Manufactured by Servette Corp., 595 Madison Ave., New York, N. Y., these mitts are unaffected by grease, acids, or stains. They allow hands complete freedom of action and fit, with equal ease, on either hand

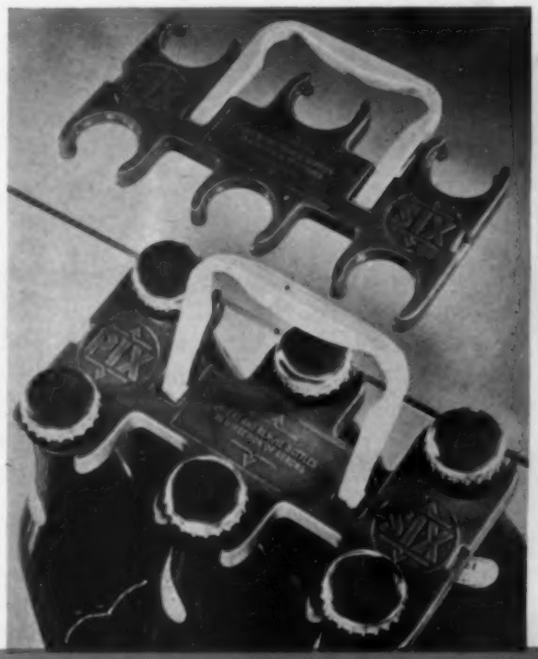
A temper and time saver, this tiny Saftizip fits on the head of standard zippers and prevents clothing and parts of the body from being caught in the zipper track. Put out by Dr. Allan Bloxom, 4402 Travis St., Houston, Texas, it consists of a nylon guard and stainless steel lock-on. The guard is molded in two sizes by Nalle Plastics, Inc., 108-10 W. Second St., Austin, Texas. Various colors are applied as an afterdip

PLASTICS

A pre-focused spotlight and a bendable loop soldering tip which generates soldering heat in 5 sec. are among features of the Solderlite soldering gun put out by the Weller Mfg. Co., Easton, Pa. Penn-Plastics Corp., Glenside, Pa., molds the black housing and red trigger of Durez phenolic. Plastic was used to give the gun a streamlined appearance and good balance

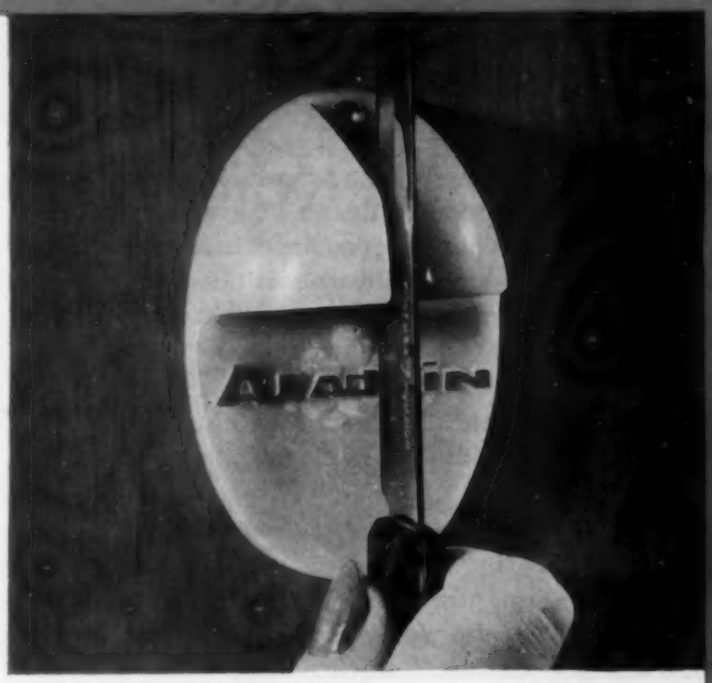
Breakfast or luncheon tables take on a cheery colorful air with these attractive rosebud salt and pepper shakers. Small sets are available for individual place settings. Larger sets for family use with pastel colored bud tops and green leaf-like bases are also obtainable. Molded of Lumarith cellulose acetate by Jaydon, Inc., 482 Broome St., New York 13, N. Y. Acetate was selected for its true colors, high luster, and good mechanical strength

Six bottles of cola, pop, or beer can be carried home easily with Pix-Six carrier molded of Tenite II cellulose acetate butyrate by the U. S. Plastics Corp., 2853 W. Irving Park Rd., Chicago 18, Ill. The rounded handle makes it easy to carry. Loaded, it can go directly into refrigerator; empty, it can be folded to fit into purse or pocket



Sanding or polishing can be accomplished in a jiffy in home or workship with the Moto-Sander which holds a rubber-cushioned sanding pad or felt polishing pad measuring 2¼ by 5½ inches. The cover or handle is made of black Bakelite phenolic by Chicago Molded Products Corp., 1020 N. Kolmar Ave., Chicago 51, Ill., for Dremel Mfg. Co., 2420 18th St., Racine, Wis. Because of its small size, the Moto-Sander can be used in hard-to-get-at places

PRODUCTS



A keen properly angled edge on blades is assured with this compact wall type sharpener which requires only one screw for mounting securely on door frame or kitchen-cabinet door. It consists of a Carboloy sharpening agent housed in a Tenite cellulose acetate case. Plastomatic Co., Fitchburg, Mass., injection molds this housing for New England Carbide Tool Co., Inc., 60 Brookline St., Cambridge 39, Mass.

Attachments for facial, muscular, or scalp massage make this palm-size Kwik Way massager quite versatile. The ball shape housing is molded in two parts of Koppers polystyrene by Livingston Plastics Corp., Northbrook, Ill., for Knapp-Monarch Co., Bent Ave. & Potomac St., St. Louis, Mo. This plastic was chosen for its high heat resistance, luster, and moldability

delivery?

AT MIDLAND IT'S FASTER THAN A CAT CAN HAVE KITTENS!

This wall socket hobbed cavity by Midland incorporates two narrow "T" projections raised 3/16 inches above the cavity surface. By using hobbed cavities of this type in place of the conventional insert cavities, all unsightly parting lines were eliminated and in addition to improving appearance, the hobbing was accomplished at only a fraction of the cost of cavity duplication by machining methods.

Yes, actually! It takes a cat nine weeks—and on most hobbed cavity jobs we do a *lot* better than that! Our skilled craftsmen, our machining, engraving and hobbing equipment are working constantly, accurately on a schedule that means delivery of hobbed cavities in a matter of weeks —not months. Whenever you order from Midland you are assured the kind of accurate, uniform, perfectly finished hobbed cavities that only skill and experience can provide.

So if limited molding capacity and long quoted delivery are holding you back, grab the problem by its neck and bring it to Midland where delivery is shaved to a cat's whisker.

For a clear picture of our equipment and our know-how, write for a copy of "Shaping Tomorrow Today." Better still, send your blueprints!

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D&E

Engineering Progress

BEFORE reviewing the engineering, machinery, and production method developments during 1948, as reported in MODERN PLASTICS, it will be helpful to go back a few years and survey a number of facets of plastics engineering. Accumulated experience now permits an evaluation of the importance of many such developments.

Jet molding can now be classified as one development which, although of intense interest several years ago, has to all practical purposes been discarded as a method of molding thermosetting materials. However, at the time of its announcement, and for a few years thereafter, it was of vital importance to the war effort because it permitted the use of idle injection molding machines for molding thermosets.

Cast molds for compression, injection, and transfer molding, made by different methods and with many materials, have been thoroughly dealt with in these pages during the past few years. Many of the materials used for cast molds have been found to be unsatisfactory but there is still hope that the problems inherent in such molds will be overcome if adequate research is undertaken by the companies producing the metals and the companies producing the molds.

That many lessons can be learned from failures has been proved by the history of what is probably the oldest type of cast molds for plastics. For many years beryllium copper has been promoted as a material for molds. Its one advantage is the fact that a mold cast from beryllium copper generally costs a lot less money than one produced by machining or hobbing. But molders using these molds have often been far from happy. Dimensional accuracy was lacking. Surface finish was poor. The molds were too weak for compression molding and, in many cases, porosity in the molding surface made it necessary to scrap parts.

In the past year or two this picture has changed. The quality of the alloy has been improved, but the biggest factor in improving these cast beryllium molds has been a change in production methods. No longer is the molten metal merely cast around a form. Rather, a steel hob is forced into a bath of the molten metal. This process, generally called hot hobbing, is now being used to produce excellent cavities. Their value is particularly evident in the toy industry where intricate detail is required.

Better quality plastics merchandise

Additional examples of successes and failures similar to those discussed above could be cited, but in the main it has been new methods, machines, and processes which have been directly responsible for increasing and bettering production. Such developments as high frequency preheating, plunger molding, extrusion of thermoplastic sheeting, and a multitude of others have caused a steadily rising trend in better quality plastics merchandise.

During 1948 there have been many innovations. Some of these are already in wide use; others have yet to make their full impact. All of them appear to be fundamentally sound, although some may take a few years before they are widely accepted.

A completely different method of molding thermosetting materials known as Tri-dyne molding has been developed by the Defiance Machine Works, Inc. It is a two-stage process, more details of which are given in a latter part of this review. Although Tri-dyne molding will probably not have as wide application as transfer molding, it should certainly be carefully investigated as a new tool for the plastics industry. It may make possible the molding of large homogeneous sections of thermosetting parts without the use of expensive preheating equipment. Its greatest impact may well be on the electrical industry because of the claim that the process removes practically all the moisture from the molding material.

During the past few years, MODERN PLASTICS has published articles dealing with thermoplastic laminates. When first reported, the methods used for producing these laminates seemed quite feasible. Several attempts were made to use them as semi-

*Reg. U. S. Patent Office.

structural components in such items as luggage, but without commercial success.

While this work was going on, Woodall Industries, Inc. carried on a series of somewhat parallel experimental developments which now appear to be successful from the angles of production methods as well as of price. The company claims to be able to laminate a paper or fabric filler with any one of several thermoplastics by compression molding the core material and molding powder into a laminate which is produced at a lower cost than can be attained by laminating the filler between two sheets of extruded or cast stock. After being produced in flat sheet, the laminate can be post formed with inexpensive molds into such items as radio cabinets, decorative trays, and passenger car arm rests. A wide diversification of applications is foreseen for this type of laminate, described in the article "Compression Molded Thermoplastic Laminates and Sheets," MODERN PLASTICS, April 1948, pages 118-120.

The article "Molding and Finishing Instrument Dials," MODERN PLASTICS, March 1948, pages 105-108, did not deal with a completely new process for either molding or finishing, but it did indicate the desirability of custom molders becoming flexible enough in their operations to change their methods as the occasion demands. For example, it is well known that a clock face practically identical in design, shape, and material to the dials illustrated in this article has been produced by several molders, some using compression molding and others using injection. Many difficulties were encountered in these operations—flow lines, poor filling-out around the numerals, weak weld lines opposite the gate when side gated for injection molding, and meeting dimensional tolerances.

The article on instrument dials, dealing with work done at the A. C. Sparkplug Div. of General Motors Corp., points out methods of eliminating these difficulties. Hence it should be required reading for any engineer who is contemplating production of a part similar in construction to an instrument dial or clock face, especially if it is to be made of transparent thermoplastic. If these methods of gating, venting, and finishing are followed, it will frequently be found that costs will be reduced and quality improved. Hand in hand with these advantages, of course, will go greatly increased markets for items of similar nature.

Large molded pieces

There has been a great deal of talk in the industry regarding the increase in size of plastic molded parts. The article "How Big Can Molded Pieces Be?" MODERN PLASTICS, October 1947, pages 101-106, indicated that such a trend was not marked in this class of materials. In thermoplastics, however, the demand for larger and larger parts of thermoplastics has made itself felt, and the molders in turn have demanded larger capacity injection molding machines. The manufacturers of these machines have come through with flying colors and today practically all of them are producing machines with capacities of at least 22 oz. and in many cases of 40 ounces. One machinery manufacturer, in fact, has his top capacity listed as 80 ounces.

The case for a large Exide storage battery which won an award in the Seventh MODERN PLASTICS Competition was originally produced in two pieces. Today, the 11 lb. of polystyrene needed for this job are being molded in one shot by a process resembling transfer molding. Refrigerator manufacturing companies are getting larger and larger thermoplastic components for their products, most of them molded in one piece on standard injection machines.

These facts behoove the thermosetting industry to take stock of their available equipment because in most cases this equipment is the limiting factor in permitting the molding of larger thermosetting parts.

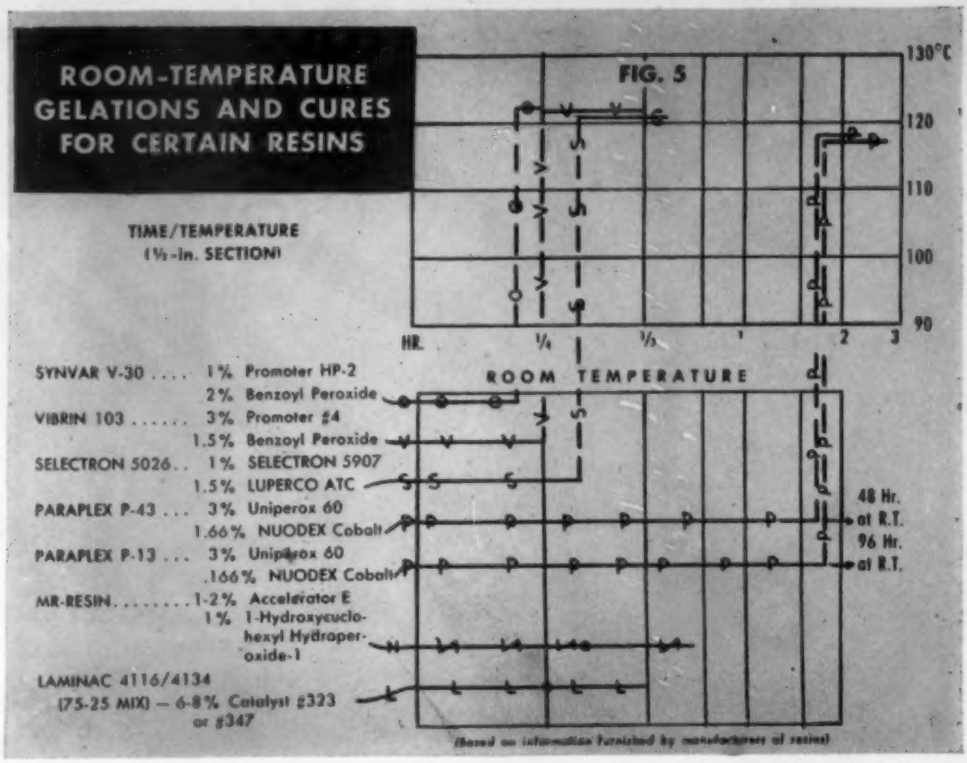
Multiple-shot molding

The articles, "Multiple-Shot Molded Parts," MODERN PLASTICS, April 1948, pages 129-134, and "Plastics in Adding Machines," December 1948, pages 88-90, indicate a trend toward this type of injection molding, where two colors of material are used. In this process, one section of the finished piece is first molded; then this part is used as an insert in a second mold where the additional different color material is injection molded around it.

While this process is a desirable development, it is possible to carry it one step further to a point where only one operation is necessary to produce a multicolored piece. In fact, one company, whose name cannot be divulged as yet, is reported to be producing such multi-color injection molded parts in what amounts to one operation. From the time the mold is closed until the time the two-color moldings are removed, all operations are mechanical and automatic. With this work on two-color molding progressing rapidly, it should not be very long before all injection molders will be offering multi-color parts not limited to two colors but made up of three or even four different colors combined in one piece.

MOLD TECHNIQUES FOR POLYESTER CASTING

THE resins grouped roughly under the name "polyesters" may prove highly important to the plastics industry, despite obstacles of misunderstanding and misconception which have beset their path. Because polyesters are easily cast, there is grave danger of their damnation as a hobby and crafts material, or as a slightly superior medium for the plaster caster or, equally bad, as a substitute for older castable



One of a group of charts which appeared in connection with the original article on "Mold Techniques for Polyester Casting", abstracted below. Other charts with the original article presented data on basic two-step cures for certain resins and exotherm curves for combinations of resins and catalysts in specified proportions

resins. Because casting procedure is at sharp variance with accepted methods of working plastics, potential producers hesitate to learn new rules. Perhaps worst of all, the feature of castability obscures many of the unique properties obtainable in the cast products—properties in the aggregate unparalleled in any other plastic group.

Polyesters are—here and now—usable production casting materials, however much more they may improve with time. Only inexpensive molds are needed. Room-temperature cures are frequently feasible. Complicated decorative or utilitarian objects can be turned out in more than reasonable quantities with only rudimentary equipment. By choice of resin and cure, the producer can select water-white clarity or unlimited color—transparent or opaque—rigid hardness approaching that of urea or the soft flexibility of a near-elastomer. He can have heat resistance as high as 450° F.—and almost any polyester will withstand boiling water. Chemical resistance and electrical properties are excellent; there are flameproofing and self-extinguishing types. Other properties allow specialized applications.

True, not every polyester resin has every one of these properties, but by suiting material to purpose, sound and salable merchandise can be produced to sell at a profit. True, also, no competition in volume with injection and compression molding can be visualized at this time. The cycle of casting, although brought down to minutes in many cases, is still overlong for single expensive molds. Multiple, inexpensive cavities are definitely indicated, with 5,000 to 10,000 runs rather than 50,000 to 100,000 as a production basis. But the range of qualities available, equalling or surpassing many other plastics, indicates an adaptability to new and unconventional techniques that is stimulating to the imaginative. Ask what other plastics—and many metals—cannot do; ask what the latest methods of yesterday could not attempt. Then do them with cast polyesters.

(MODERN PLASTICS, August 1948, pages 103-110)

INDUCTION HEATED MOLDS

IN the new Zenith "75" hearing aid, the two-conductor cord which runs from the unit to the ear piece is very flexible and is coated with vinyl insulation which, of course, is also very flexible. At the end which fits into the ear piece, it is necessary to apply, at a Y-joint, a harder and less flexible vinyl covering next to the extreme ends of the conductors, in the form of sleeves slipped over the wires.

After the sleeves are in place, they are softened and molded in eight-cavity molds, in an air-operated press. The method of heating the mold is so different from that usually used that it should be of interest to every fabricator and molder.

An open coil, made up of a few turns of heavy gage wire, has been incorporated into a special type of mold fixture. When a high frequency current is passed through this coil, an alternating magnetic field is set up in the space surrounded by the coil. When the metallic mold is placed in position and

(*Please turn to page* 96)

Exotic

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HOLLYWOOD MAKE-UP KIT

BEAUTIFULLY MADE FROM

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designed color
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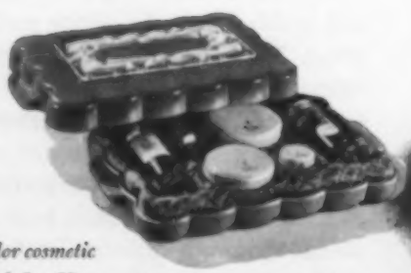


This Plaskon Molded Color cosmetic make-up kit is produced for Max Factor Hollywood by Eldon Manufacturing Co., Los Angeles, Calif.

PLASKON
MOLDED COLOR

*Trade Mark Reg.

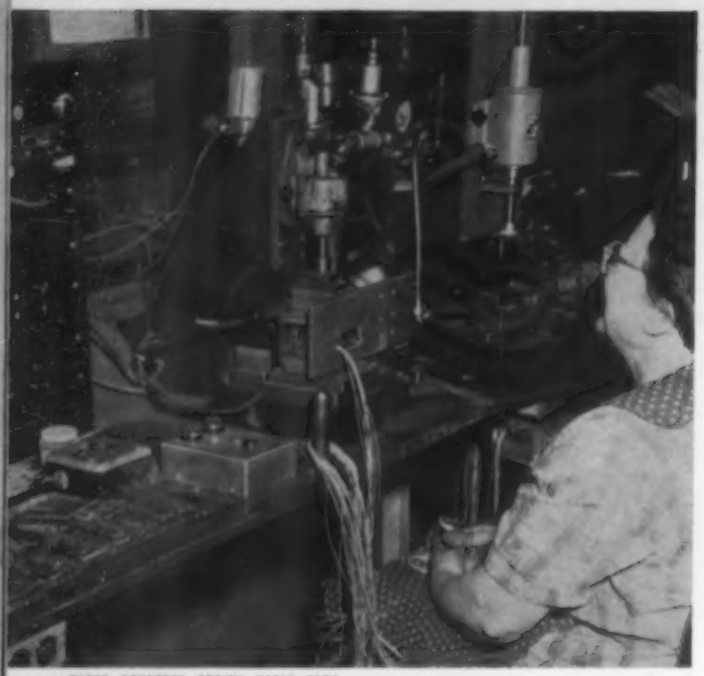


PHOTO COURTESY ZENITH RADIO CORP.

Rigid vinyl sleeves are softened in induction heated mold, center, bonded to insulation, then cooled in press at right

clamped by the air cylinder, it is directly in the field. When power from the high frequency oscillator is passed through the coil, the mold itself is quickly heated. The hot mold, in turn, softens the relatively rigid vinyl sleeves so that they bond to the flexible vinyl insulation.

As soon as the plastic is hot enough to flow as required, which occurs at the end of a predetermined time, the current is shut off, the press is opened, and the mold is shifted to a second air-operated press where the mold remains until cool enough for the moldings to retain their shape.

The principle of induction heating of a mold which is involved in this setup should find many applications for the processing of plastic materials. Of course, engineering ingenuity will be required for each individual setup. However, the advantages to be gained by such a method should go a long way toward proving this type of operation.

(MODERN PLASTICS, July 1948, page 114)

CASTING POLYESTERS

TWO major factors have held up progress in polyester casting—the curing cycle, with its required exact control of heat and catalyst, and the lack of adequate mold materials.

The first handicap has all but vanished under the combined assault of resin and catalyst manufacturers. It is entirely feasible to cast polyesters at room temperature with, at worst, a brief postcure in the oven, and even that step in the process may often be eliminated.

The second handicap has been side-stepped too frequently with vague generalities. A potential manufacturer needs information on specific, usable materials that can be adapted to the type of item he wishes to produce. Fortunately there are materials available in both rigid and flexible form which meet requirements of cost and adaptability. Unfortunately it is an economic necessity that the said potential manufacturer must learn to handle these materials himself, in his own plant as part and parcel of his operation.

While polished metal or glass give best mold surfaces and easiest release, the limitations in cost and adaptability are obvious. The same applies to glazed ceramics. Tooling or hobbing is out of the question when 50 or 500 cavities are needed, although cast glass molds have been used and sheet glass or metal has been assembled into simple forms. Sheet acetate pinch-hits for purely temporary work at low temperature. Some rod stock is now being poured in glass tubes, which are broken to free the castings. Lead molds, made by dipping mandrels into molten metal, have been inherited intact from phenolic casting. Low-melting alloys (1)[1] show promise when similarly handled or they may be cast in plaster to give relatively inexpensive cavities. Where draw permits, multiple molds may be stamped of sheet aluminum or brass. Electroforming comes within reason for some applications, since the deposit can be kept extremely thin. None of these is completely free from shortcomings—and the resin used must be considered; some metals inhibit cure.

Sprayed metal molds seem most practical from the dual standpoint of economy and utility. Their production requires multiple masters of plaster or cast stone, since respraying is not always feasible, but the cost per cavity can be held down to two or three dollars or considerably less if a gun is installed by the caster to make his own molds.

Sprayed molds must be thoroughly sealed before use. Mold sealing can be done in three ways. Hot melts—standing up to cure temperatures—can be used. Several high-melting waxes and moderately resistant plastics are suitable (2, 3). Certain other plastics (3, 4), give an excellent finish and seal. Some coatings adapted to spray, brush, or dip application—air-drying or baked on—stand up very well under continued usage (3, 5). Any coating—as opposed to impregnation sealant—should be applied inside and outside to give complete seal and avoid lifting.

The heat conduction of metal is a great advantage in dissipating exotherm of curing resins, especially in closed cavities of any size. Plaster, on the other hand, is far too good an insulator; heat is trapped

[1] Numbers in parenthesis refer to "Material Sources" tabulation at end of this article.

and built up, sometimes with disastrous results. However, for many purposes, plaster and similar hydrates such as cement and cast stone can be used for temporary molds. Plaster eventually breaks down with continued heatings.

All such materials must also be sealed for casting release and, when possible, deeper impregnation is the best insurance of maximum life. Agar-agar, algin, or alginates (9), methyl cellulose (6), carboxymethyl cellulose (8), and polyvinyl alcohol (7) may be painted on in water solution. These should be plasticized to prevent cracking and can profit from the addition of wetting agents (10). Some such coatings come prepared ready for use by the mold maker (3).

Deeper impregnation can be obtained with low-viscosity, thermosetting plastics, and in some cases these can be mixed directly with the hydrate in making the mold (11, 12, 13). Others are applied by dip or successive spray coats built up without intermediate drying to obtain maximum penetration (3, 14, 15, 16). These are available in both air-drying and heat-cured forms.

Where details or fins jut into the cavity or where a central core rises in the mold, such projections can be gripped by polymerizing resin with sufficient force to tear them out bodily. Or, just as bad, the resin cracks upon them. The problem may be sidestepped by removing castings while still flexible—though tender—before shrinkage is complete, or by using flexible molds or mold sections.

The conventional flexible mold material is the hot-melt vinyl chloride based on Koroseal or Korogel (17), requiring protective coatings, frequently renewed, for many resins. One new formulation, based upon a Thiokol rubber, cures at room temperature but presents problems where more active resins are concerned (17, 18).

Of all the available elastomeric materials, polyvinyl chloride formulations of the non-reusable, heat-cured plastisol type—not to be confused with the hot-melt type referred to above—seem most satisfactory. But even these are not perfect. The liquid resins act as solvents on plasticizers within the vinyl, causing surface hardening and susceptibility to damage.

Mold life may be prolonged by proper choice of separating agents, control of exotherm, and removal of casting in gel. Specialized forms compounded with polyester applications in mind are prepared by several firms (3, 17, 19) and under optimum conditions will deliver upwards of 100 impressions per cavity.

One other flexible material worthy of note is a very expensive composition based upon silicone rubber (3) and requiring careful handling plus long cure. To the writer's knowledge, this represents the only permanent flexible material suitable for casting acrylics and similarly active monomers.

Ideal mold construction for most purposes, and by far the most adaptable, is a combination of rigid and flexible parts, using sealed sprayed metal or metal inserts to hold plane surfaces and dimensions.

Although many polyesters release directly from sealed metal or flexible vinyl, the use of separating agents is advisable. Some special preparations such as Ortholeum (7), Vejin (20), and Polyplastex #595 (21), have been recommended. Experience has shown that silicone mold release fluids seem to give better results (22, 23), but these, or any other agent, must be used in minimum quantity. Dilution and allowing the solvent to evaporate before using the mold, is very desirable and permits application by atomizer or spray gun. One modified silicone comes ready prepared with solvent for such use, and contains additional active agents which aid in obtaining firm surfaces and easier release (3).

Pertinent to the manufacturer is the salient fact that polyester resins exist; that their cure is simplified enough so that, with proper care and preparation, production runs can be undertaken; and that there are mold materials in which the resins can economically be cast. It is added profit that with such molds castings may be produced in a variety and complexity that no other method of practical production can hope to equal.

Material Sources

1. Cerro de Pasco Copper Corp., 40 Wall St., New York, N. Y.
2. Glyco Products Co., 26 Court St., Brooklyn, N. Y.
3. Multi-Mold Products, 18 West 37th St., New York, N. Y.
4. U. S. Stoneware, Akron 9, Ohio
5. Durite Plastics, Inc., Frankford Station, P. O., Philadelphia, Pa.
6. Dow Chemical Co., 30 Rockefeller Plaza, New York, N. Y.
7. E. I. du Pont de Nemours & Co., Inc., Arlington, N. J.
8. Hercules Powder Co., 921 Market St., Wilmington 99, Del.
9. Kelco Co., 31 Nassau St., New York, N. Y.
10. American Cyanamid Co., 30 Rockefeller Plaza, New York, N. Y.
11. Palestic Corp., 316 North Laflin St., Chicago, Ill.
12. American Resinous Chemicals Corp., Peabody, Mass.
13. Resinous Products & Chemical Co., Washington Sq., Philadelphia, Pa.
14. Irvington Varnish & Insulator Co., Irvington, N. J.
15. Naugatuck Chemical Div., 1230 6th Ave., New York, N. Y.
16. Bakelite Corp., 30 East 42nd St., New York, N. Y.
17. Perma-Flex Mold Co., 243 North 5th St., Columbus, Ohio
18. Fleximold Company, 43 Wooster St., New York, N. Y.
19. Applied Resins Corp., 304 Oraton St., Newark, N. J.
20. Vejin, Inc., Cincinnati, Ohio
21. Polyplastex Co., Woodside, L. I., N. Y.
22. Dow-Corning Corp., Empire State Bldg., New York, N. Y.
23. General Electric Co., Pittsfield, Mass.

(MODERN PLASTICS, July 1948, pages 115-119)

DIMENSIONAL CONTROL IN EXTRUDED TUBING

EARLY attempts by the extrusion industry to produce thin walled tubing of uniform thickness and diameter involved the extrusion of a relatively heavy walled tube, followed by inflation and stretching of the latter to the correct diameter and thickness. The difficulty in maintaining dimensional control has made this process impracticable for most work and indicated the need for a better method.

A cooling die or sleeve appeared to be the logical solution to the problem, provided excessive inflation could be eliminated.

In preliminary testing, lengths of approximately 25 ft. of Vinylite plastic rigid tubing could be extruded satisfactorily but greater lengths could not

(*Please turn to page* 100)

The Gruen Watch Company wanted a box of a material that would speak instantly of high quality for watches that do the same. BEETLE plastic was selected . . . as ideal for eye-appeal, performance qualities and molding characteristics that readily accommodate special hinge constructions such as the Rathbun Triple Spring Hinge. The BEETLE plastic box was developed by the Electric City Box Company, Buffalo, and molded by Rathbun Molding Corporation, Salamanca, N. Y.

To attract the eye to a quality buy...

They're using beautiful, low-cost, easy-to-mold BEETLE* plastic boxes

Permanently colorful, lustrous BEETLE plastic boxes make perfect settings for sales. They're *quality* and look it . . . steal the eye on any counter, in any display case. *Yet, they are easily molded, at low cost*—are chemically inert, dimensionally stable, highly resistant to abrasion, wear and impact, and are extremely easy to keep clean.

With such a combination of virtues, it is easy to understand why BEETLE plastic has long been the choice of manufacturers for display packaging of watches, necklaces, cuff-links and similar products that require a fine environment and good protection—at reasonable costs. And no wonder that these manufacturers are welcoming the news that BEETLE molding compounds are again in plentiful supply.

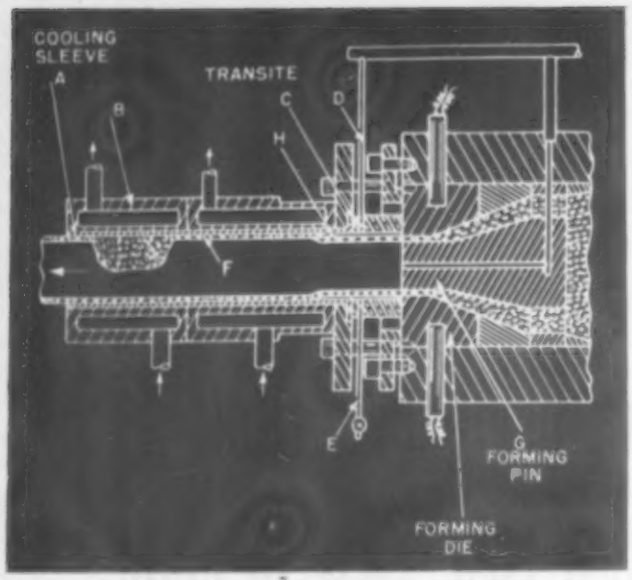
If *you* want a packaging container or box molded of the same compound that has played important roles in many sales successes—BEETLE Plastic—consult your molder or Cyanamid today. American Cyanamid Company, Plastics Department, 32 Rockefeller Plaza, New York 20, New York.

BEETLE* plastics—urea-formaldehyde thermosetting molding compounds. MELMAC* plastics—melamine-formaldehyde thermosetting molding compounds, industrial and laminating resins. URAC* resins—urea-formaldehyde thermosetting industrial resins and adhesives. MELURAC* resins—melamine-urea-formaldehyde thermosetting resin adhesives and laminating resins. LAMINAC* resins—thermosetting polyester resins. *Reg. U. S. Pat. Off.

AMERICAN *Cyanamid* COMPANY

PLASTICS DEPARTMENT

32 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.



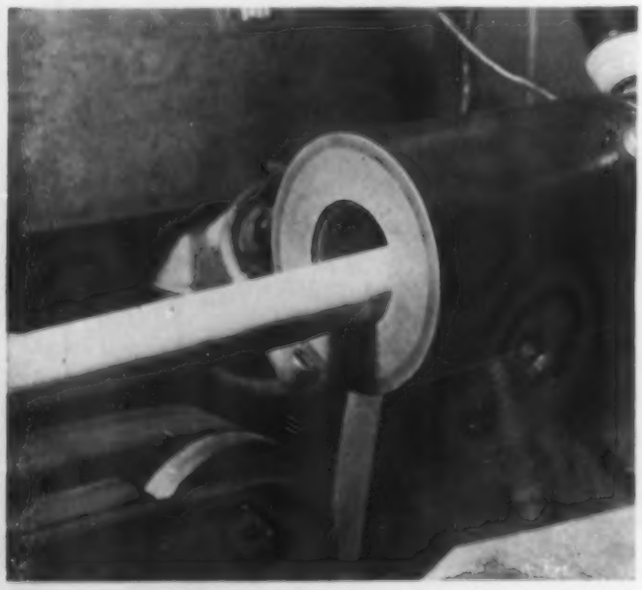
Opposing air pressure between tube and cooling sleeve keeps extrusions from rupturing within the cooling device

be made because of tubing rupture somewhere within the cooling device.

To correct this condition, it appeared that an opposing air pressure in the space between the hot plastic tube and the cooling sleeve was required in order to prevent the extruded tube from expanding back against the forming die.

To accomplish this objective a tube, D, connected with the air line leading to the opening in the forming pin, was inserted through the Transite insulator as shown in the drawing. A bleeder tube, E, with pinch cock or control valve was then inserted through the Transite insulator opposite D to provide a control for the pressure in zone H.

An extruded tube to which air pressure has not been applied, showing size compared with the cooling sleeve



The ideal condition is achieved when the pressure in H is slightly below that in F, as when the control valve in E is slightly open. When this condition is established, the extruded plastic tube expands against the cooling sleeve, but cannot expand back against the forming die, due to the opposing pressure in H.

Despite the elimination of other obstacles and deficiencies, adhesion prevented continuous extrusion since considerable force was required to draw the cooled extruded plastic tube through the cooling sleeve. The inner surface of the sleeve was then acid etched to a light matte finish, and with this etching, which provided a discontinuous contact surface, the continuous extrusion of thin walled rigid Vinylite plastic tubing was finally accomplished.

It is important to note that the matte surface of the cooling sleeve does not detract from the smoothness or gloss of the extruded tube. The cooling sleeve may be of either steel or brass and should be lightly chromium plated to prevent excessive wear.

All of the foregoing work was directed toward the production of tubing with an inside diameter of 1.250 in. and a wall thickness of about 0.020 inch.

Later work indicated that a die of 1.00-in. diameter and a forming pin of 0.900-in. diameter functioned better with a 1.290 in. cooling sleeve, and that this combination made it possible to extrude tubing varying from 0.005 to 0.030 in. in thickness with an outside diameter of 1.290 inches.

On the basis of this information, it would appear that the area of the forming die opening should be from two to three times that of the intended cross sectional area of the extruded tube, and that the forming die should be approximately 20% smaller in diameter than that of the cooling sleeve for the extrusion of Vinylite rigid plastic.

The preferred die of 1.00-in. diameter noted above was provided with a 0.50-in. land when used with the 0.90-in. pin. It is possible that a reduction in land length to ¼ in. might effect an increase in extrusion rate but at the expense of surface finish.

Cooling sleeves of 6, 8, and 10-in. length were employed and the 8-in. length found quite satisfactory for extrusion rates up to 80 lb. per hour.

Extrusion of other plastics

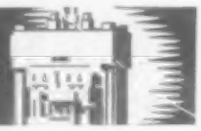
(a) *Vinylite non-rigid plastic.* Vinylite elastomeric compounds containing under 15 to 20% plasticizer may be formed by the technique outlined previously, but not those having higher plasticizer concentration.

(b) *Tenite II.* This material (and specifically Formula 205E plasticity H) has been successfully extruded, with the assembly and technique here described, with good success. However, Tenite II appears to expand much more than Vinylite rigid plastic when it emerges from the forming die so that the die and pin sizes noted for Vinylite plastic do not apply for Tenite II.

For the latter, an 8-in. long brass, ⅛ in. thick, cooling sleeve matted and flash chrome plated (0.0001 in.) was employed. Tubing with a 0.020-in. wall and 1.246-in. inside diameter was extruded with a cooling sleeve of 1.310-in. inside diameter. The forming die had a diameter of 0.859 in. and the forming pin 0.800-in. diameter.

(MODERN PLASTICS, September 1948, pages 191-193)

UNIQUE MOLDING PROCESS



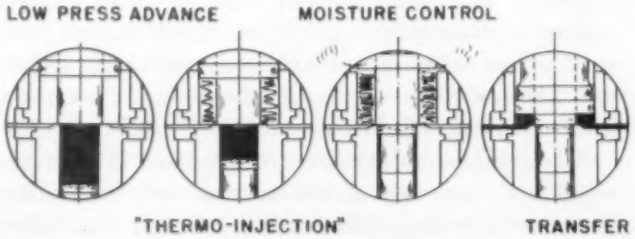
A NEW plastic molding process differs from popular "transfer and plunger type" molding techniques in that two stages of injection are used instead of one. Presses built by Defiance Machine Works for this new Tri-dyne (patents pending) process have already provided a background of production experience at Plastics Research Products Co., Urbana, Ohio. The use of two stages in one molding press results in three desirable operating features which are as follows:

1. Fast, uniform heating
2. Thorough mixing
3. Accurate moisture control

In the Tri-dyne process, the operator places a moderately preheated (140 to 240° F.) charge of material, either granular or preformed, into the loading pot of the open press. The mold is then closed by the main ram and subsequently the "thermo-injector" is advanced by low pressure. Application of high pressure to the main ram clamps the mold halves securely together. Simultaneous operation of the "thermo-injector" then forces the material charge in 3 sec. or less through the annular orifice into the transfer pot. During this operation a hign (from 20,000 to 40,000 p.s.i.) and substantially constant pressure drop is maintained across the restriction.

With the press closed, the orifice formed by the top inside edge of the loading pot and the lower outside edge of the fixed core will have a thickness in the range of between 0.005 and 0.065 in., depending upon the physical characteristics of the material being handled. After a dwell of 0 to 10 sec., which permits the desired amount of moisture vapor to leave the system, the transfer ram moves down to push the material through the runners and gates into the die cavities. The unit transfer pressure of 1500 to 7500 p.s.i., which is substantially less than that used for "thermo-injection," determines the projected die area that may be used with a given die clamping force. After a short cure interval the press opens and the molded parts are removed, the mold scavenged, and the operator is ready to start the next cycle.

Left to right: Steps in the new molding process, which by employing two stages of injection, provides fast uniform heating, thorough mixing, and accurate moisture control



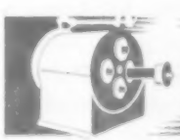
Automatic cycling equipment is required for carrying out this process because accurate time control is essential.

From the standpoint of speed and quality control, production record to date has been exceptionally good. Comparative tests under similar operating conditions (material, mold temperature, etc.) have shown that the weekly production of the presses using the Tri-dyne process has been 20 to 90% greater than that of single stage plunger presses with H. F. preheat. Furthermore, the unit transfer pressure and total clamping force required in the Tri-dyne process was only 50% of that required in the single stage method. The 90% production increase was achieved in comparative tests using the same mold and material.

In molding a 5/16-in. thick blister-free part of BM 3200 at a mold temperature of 315 to 325° F. only 20-sec. total time was required for the transfer and the cure.

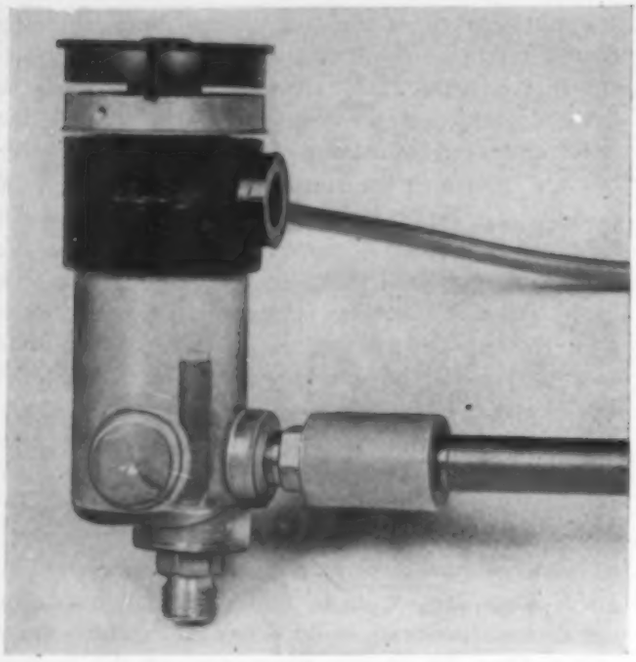
(MODERN PLASTICS, May 1948, pages 116-118)

DEVELOPMENTS IN STEAM PREHEATING



THE importance and desirability of automatic molding presses for the plastics industry have long been evident. The success of such equipment for thermoplastic materials has stimulated the attempts to develop similar automatic equipment for thermosetting materials such as the phenolics.

When a large expansion program was begun in the Plastics Div. of Minneapolis-Honeywell Regulator Co. a few years ago, the possibilities of using such equipment were seriously considered. It was decided at that time to design all new presses so that they could be easily converted to automatic operation. It was decided also to use transfer molding as far as possible and to build the new presses to allow for the addition of steam preheater units at some future time. In the meantime, steam preheaters of various designs were built for production jobs in order to more thoroughly test them out and to de-



Control of moisture in the steam preheater is accomplished by means of a furnace type dripper which is mounted outside the oven. The rate at which the water drips onto the oven floor is governed by turning the knob at top of unit

velop the most suitable design of steam preheater.

One major problem has been the control of the amount of moisture put into the heating atmosphere. An early oven used a series of water sprays which injected a water mist into the air stream of a circulating air oven. The orifice in each spray head soon was clogged with the minerals precipitated from the water and had to be cleaned out periodically. This method was then replaced by a simple type of flowmeter for steam.

Flowmeters of the rotometer type have been tested and found very useful. However, the delicate nature of many of these instruments as well as their relatively high cost makes them somewhat unsuitable for shop use.

At present a simple furnace type dripper humidifier is being used to introduce moisture in the form of water dripping onto the floor of the preheater where it is instantly converted to steam. By this means control of the moisture in the oven atmosphere can now be maintained closely enough so that automatic loading and preheating equipment can be built. Work has been done on an electronic relative humidity control which may lead to the development of a suitable control for the range of temperatures encountered in steam preheating ovens.

Special tests have been run to determine the effect of delaying the loading of preheated preforms up to one minute after removing them from the steam preheater. Fully satisfactory transfer molding of most parts was possible even with the delay.

With suitable moisture control and with the possibility of delaying loading of preforms if necessary due to slight delays in the molding cycle, the main problems in automatic preheating as used in automatic transfer molding have become insignificant.

Control of moisture content is a very important advantage of steam preheating in that it makes possible the tailoring of a material to suit a specific job. Thus when one characteristic such as tensile strength is particularly needed, it is possible to adjust the preheating to obtain the moisture content which gives the maximum value for that characteristic. It is not often possible to reach the maximum in all characteristics at one time, but a suitable combination of values may usually be attained.

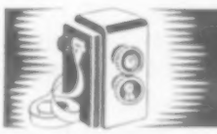
It is also possible to vary mold shrinkage appreciably by varying the amount of moisture in the oven. It has been reported previously that shrinkage is directly proportional to moisture content. In several cases this has been of definite help in compensating for off-size molds or for variations in the shrinkage of materials from batch to batch.

Except in extremely severe electrical conditions, the use of steam preheating is entirely suitable for molding electrical parts. Even with 30 drops of water per min. in the preheater, the dielectric strength of the molded part exceeds 300 volts per mil.

It is encouraging to note that continuing work with steam preheating brings out further evidences of its suitability as a production process in the vast majority of phenolic molding applications. C. G. Phillips' work[1] in Great Britain indicates that his work confirms the previous report on steam preheating.[2]

[1] "British Plastics," August 1947, pages 330-332.
[2] Modern Plastics, February 1947, pages 141-147.

(Modern Plastics, May 1948, pages 107-112)



ENGINEERING A CAMERA

THE greater portion of the new Ansco camera is composed of three polystyrene parts—the main body or carcass, the back cover, and the front panel or lens board. The winding knob for the take-up spool is produced from cellulose acetate and a small press-fit ring, used to secure the front finder lens in a zinc die casting, is molded of cellulose acetate butyrate. A translucent carrying strap is produced from extruded vinyl and a small shutter lever release button, a distinguishing feature on all Ansco cameras, is machined from extruded cellulose acetate rod. The red index window in the rear of the camera is die cut from cellulose acetate sheet stock.

All of these materials were specified for definite reasons. In the case of the carcass, back cover, and lens board, polystyrene was chosen for its dimen-

sional stability and high heat distortion point. As a matter of fact, Dow Chemical Co. developed a special high heat resistant formulation especially for this application.

Throughout the entire engineering and development of this camera, the office of Henry Dreyfuss collaborated on the design and was responsible for the general appearance of the camera. It was decided that if the wide flat areas of the sides and back were made smooth, they would be shiny and prone to show finger marks. This type of surface is also difficult to mold without showing flow lines. For these reasons the design called for milled "V" lines, 3/64 in. on centers, over the entire surface.

The main body or carcass, back cover, and front panel or lens board, are each molded in two-cavity injection molds by Plastic Manufacturers, Inc. Of these three units, the carcass presented the greatest problem from a mold design standpoint and because of the difficulties encountered in molding. When the molds were first constructed, the specifications called for comparatively thick walls at the ribbed sides of the carcass. Engineers of Plastics Manufacturers recommended that the mold be so designed as to thin out these parts and make the walls as uniform in thickness as possible. This was done by molding two holes in the top of the carcass. The molder was able to incorporate two cavities for molding plugs in the two-cavity lens board mold, thereby making a four-cavity combination mold.

The molding of the back cover and lens board can be called standard production jobs and, although they require careful attention, they do not present any difficult problems, except that of exact uniformity of contour. It is essential that all parts fit each other perfectly in order to assure light tightness.

An interesting milling and drilling setup enables one operator not only to mill the gate from the camera carcass but also to drill a small hole in the same piece. An air cylinder actuates the traverse of a milling cutter. The operator merely clamps the polystyrene carcass into the jig, presses a button, and the milling cutter traverses through its motion automatically. When the milling operation has started, the operator places a piece that has just been milled in another jig. Having clamped this into position, she presses another button which causes the drill press to operate automatically. Vertical motion on this machine is also actuated by an air cylinder.

Monaplastics, Inc. is producing the winding knob for the take-up spool of the camera in an eight-cavity injection mold. This knob is designed with a metal insert. In working out the problems connected with this job, the molder has added a bit to the technique of injection molding parts with metal inserts. He preheats the inserts before loading them into the mold. With cold inserts there would be the possibility of shrink marks becoming apparent. By heating the cavity of the mold to 165° F., and the force

PHOTO COURTESY PLASTICS MANUFACTURERS, INC.

Gates are finish-milled at right and holes drilled at left in this dual finishing setup for carcass parts of camera

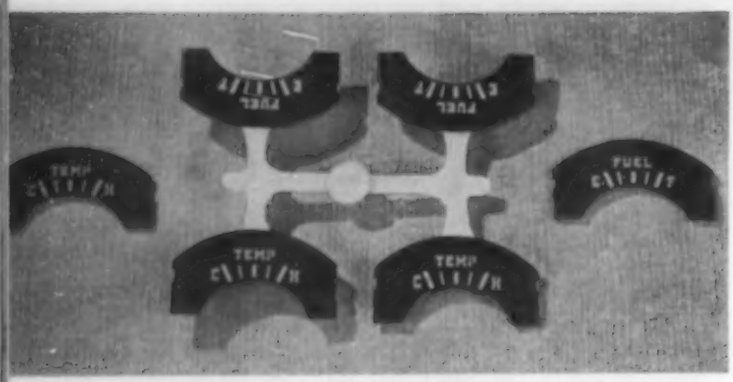
plugs to approximately 85° F., and at the same time using hot inserts, he is able to hold the close tolerances required.

One other molded plastic part used in this camera is a lens retaining ring which is being produced by Ontario Plastics Inc. in a four-cavity injection mold. Because of the thin wall section and shape of this part, the molder did not believe that polystyrene would be tough enough for the application. He also felt that cellulose acetate would not be quite good enough from a dimensional standpoint and for this reason he is producing this ring from cellulose acetate butyrate. In order to further assure accuracy of dimension, the mold was designed with a stripper plate. This enabled the operator to remove the parts from the cavities with the least possible distortion.

(MODERN PLASTICS, July 1948, pages 107-111)

MULTIPLE-SHOT MOLDED PARTS

ALTHOUGH the desirability of combining two or more colors of plastic in a single finished molded piece, without the necessity of cementing together or otherwise fabricating individual pieces, has long been recognized, the many practical difficulties involved have tended to keep such work largely in the experimental stage. Gits Molding Corp., Chicago, Ill., devoted a long period of study to this "multiple-shot" molding, as it termed the process, and made a number of parts in this manner prior to the war. Among the earliest commercial applications were Redington counter dials, which are used by the thousands on counters attached to punch presses.



On fuel and temperature gage dials, white thermoplastic is injected through openings cored in the darker component

printing presses, and other industrial equipment.

The most important large-scale use of this technique to date centers around the group of instrument board components for the new line of Hudson motor cars. Involving the use of the process on such parts as clock and speedometer faces, radio dials, fuel and temperature gages, horn button, and gear shift lever knob, this application really brings the technique out in the open and suggests its future possibilities.

On the new Hudsons, the multiple-shot pieces are molded of cellulose acetate butyrate or polystyrene, combining a rich walnut grain or black color with translucent white.

On the speedometer face, clock face, radio dial, and fuel and temperature gages, the darker color is used as a background, while figures, letters and other markings are in white, permitting the use of glare-free instrument board illumination by means of small concealed incandescent lamps. In the horn button and gear shift lever knob, the dark and light colors are combined artistically to bring out distinctive design features.

The attainment of two colors in a single molded piece is primarily a die making problem, since the preliminary molded part is placed in a second mold and employed as an insert for the second shot. However, tool design is but one of the factors which must be considered in this type of molding. Also of vital importance are such matters as selection of material, choice of colors to be combined in the finished piece, die temperature, and related factors.

It stands to reason that the first molded component must not be damaged when the second shot is made around it. For this reason, it is customary to use a material of somewhat harder flow characteristics for the first shot than for the second. This helps to prevent softening of the first shot when the second shot is made, which would result in burning or bleeding of colors.

The die must be at the proper temperature if best results are to be achieved with the multiple-shot technique. Exact temperature of the die depends largely on the size of the first shot and may range from 180 to 300° F. If the first shot is large in volume, die temperature on the second shot may be run up higher than if the first shot is small. Material in the two shots should be of the same type in order to achieve the ultimate in appearance and service from the finished casting. It is possible to combine two types of plastic in one piece, but such a combination should be studied carefully for any special problems thus created.

Although some of the details of mold design for the Hudson clock and speedometer faces differ from other parts produced by this process, the general basic theory is the same. These faces, measuring approximately 4⅞ in. in diameter, are produced in a two-cavity die which makes one of each. The pieces employ a tangential type of runner with 12 gates spaced at equal intervals around each face. The dark shots are made first, then placed in a two-cavity die for the second shot.

Another precaution against bleeding of the two shots is the use of a spring-steel ring which is laid over each of the first dial shots when it is placed in the die for the second shot.

The first shot is held perfectly flat during injection of the second shot by a number of small pins on the punch, so distributed as to contact the back of the first shot at many points near the outside edge when the die closes. Without this support from the back, the dark shot might have a tendency to buckle under the pressure of the second shot.

The speedometer face, which is combined with the clock face on a single sprue, involves the same or similar treatment all the way through. Both pieces, when completed, have sufficient strength to withstand much more strain than they will ever receive in normal service.

Close attention to design details is necessary to make full use of this process on such units as the clock and speedometer faces. Some numbers, for example, entail no special difficulty; they may be formed of a single opening of the proper shape. The simplest are those such as 1, 2, 3, and 7. Numbers like 5, 6, 8 and 9 require more intricate tooling, while 0 and 4, which normally include sections which would be cut out entirely, are actually composed of two closely-fitting openings. If desired, however, they too may be designed so that dark areas are completely enclosed by white.

Another important development in the use of multiple-shot molding is with reference to molding one intricate piece onto another, thus producing a product which, in shape and design, could not possibly be molded on any known type of machine or mold. The Gits Co. points out that here the process can yield intricate designs and shapes while eliminating great amounts of assembly work and expensive tools, dies, and equipment.

(Modern Plastics, April 1948, pages 129-134)

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Kodapak Sheet is made in two basic forms: Kodapak I, cellulose acetate, in gauges up to 20 thousandths (0.020″); Kodapak II, cellulose acetate butyrate, in gauges up to No. 200 (0.00200″).

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The Year in Review

THE stimulating forces of competition brought into operation again by the improvement in the materials supply situation were responsible for some outstanding developments in the plastics field during 1948. These new materials and products were highlighted in the S.P.I. National Plastics Exposition (1) * and in the Seventh MODERN PLASTICS Competition, (2) and will be reviewed in this survey. Educational (3) and employment (4) possibilities were discussed in two reports which gave further recognition to this expanding industry.

The cloudy international scene and its concomitant threat of war resulted in a significant measure of concentration on the needs of the armed forces for plastics in military equipment. (5) Their requirements were outlined in two conferences sponsored by the Society of the Plastics Industry. (6, 7) The modernization program was summed up in the four objectives: tropicalization, winterization, miniaturization, and ruggedization.

Materials

A new thermosetting molding compound based on a polyester type resin was introduced. (8) This compound embodies several features which make it extremely attractive to molders seeking high-speed production. It is extremely fast curing and requires relatively low pressures for molding. Its outstanding properties are dimensional stability, resistance to heat, and extraordinarily high arc resistance.

Styrene-butadiene copolymers made with a high proportion of styrene are under development by several firms. (9, 10) These are horny substances which at ordinary temperatures have none of the elastic qualities of rubber. They are compounded with rubber to produce compositions characterized by toughness, high impact strength, and heat resistance. Primary applications are in shoe soles, floor coverings, golf ball cover stock, football helmets, shipping containers, and carrying cases.

New copolymers of styrene and isobutylene produced by low temperature polymerization have been announced. (11) They exhibit rubberlike elastic properties in addition to their thermoplastic characteristics. They have a broad softening range, mix well with waxes, are easily processed on conventional equipment, and have low permeability to moisture and gases. Their films are especially suitable for the packaging of fresh and dried fruit which require retention of moisture and controlled transmission of oxygen and carbon dioxide during prolonged storage.

Polystyrenes with improved light stability, toughness, and heat resistance were announced at the National Plastics Exposition. (1, 12, 13) The first is directed toward resistance to yellowing when used indoors or when the product is not exposed directly to the weather, as in automobiles. The impact strength of the new tough styrene-type resin is three to five times greater and the elongation 10 times greater than the corresponding values for regular polystyrene. The increase in heat resistance of one type of polystyrene is attributed to more precise control of molecular chain forms in the polymer as a result of the application of principles discovered in the course of fundamental research. Portents of new polymers to come in the styrene field were revealed in other reports of research progress. (14-18)

Commercial production in limited quantities of polymonochlorotrifluoroethylene (Kel-F) was announced. (19) It combines chemical inertness and toughness over a wide temperature range (−320 to 390° F.) with ready fabrication in conventional equipment. In this latter respect it differs from polytetrafluoroethylene which, however, is continuing to find new applications in the chemical industry. (20, 21) Copolymers of chloroethylenes were studied. (22) With production capacity for polyethylene more than tripled during the year (from 15,000,000 to approximately 55,000,000 lb.), interest in this versatile plastic continued to mount. It possesses an unusual combination of desirable qualities: namely, high dielectric strength, light weight, flexibility at low temperatures, chemical resistance, low water vapor permeability, freedom from taste and

*Numbers in parentheses link to the "References" starting on page 156.

odor, nontoxicity, transparency, and ease of fabrication without plasticizer. (23)

Increased activity in the use of isobutylene as a raw material for making plastics was evident. (11) The properties of polyisobutylene blends with polyethylene (24) and waxes (25) were described.

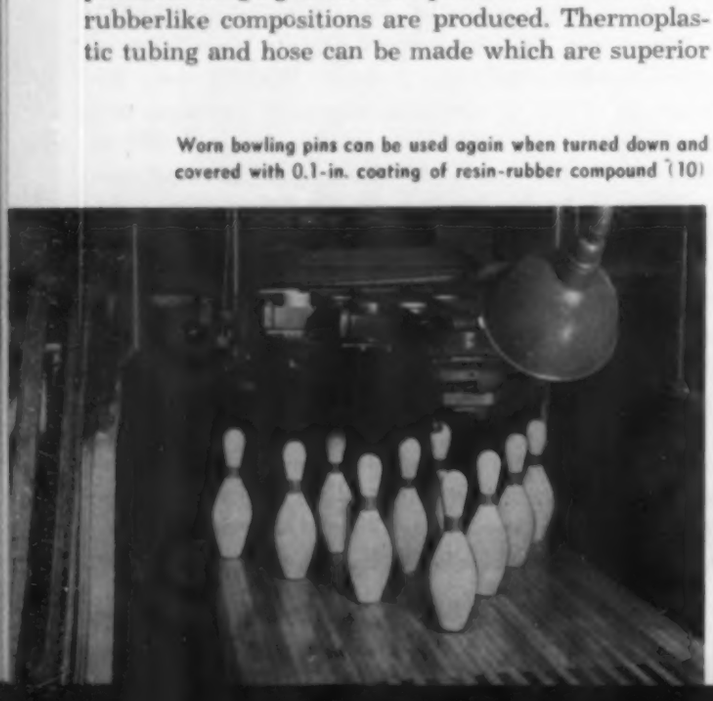
A copolymer of vinyl chloride and vinyl cyanide (acrylonitrile) has been made into a fiber which is of interest to chemical engineers in the form of filter fabric, dust fume bags, and the like. The oriented and heat-stabilized material is resistant to many acids, bases, and solvents. (21, 26, 27)

Research on polymers of various vinyl derivatives (28-31) continued to provide a foundation which insures future progress in this sector of the plastics industry. Polyvinyl resin latex (32) that will form a strong coherent film or coating without plasticizer by simply drying at or near room temperature is further evidence of the increasing importance of synthetic elastomeric latices in industrial operations. The properties of vinyl compounds containing fillers were described in two reports. (33, 34) One of these compounds is a chemical resistant material for sealing porous castings or seams in metallic structures and consists of a metallic filler and a vinyl resin. (34)

Specially compounded polyvinyl alcohol has proved to be suitable for valve diaphragms resistant to chlorinated and aromatic hydrocarbons. Another type is entirely resistant to cold water and is not dissolved by hot water up to 160° F. (35) Polyvinyl alcohol is also useful as an emulsifying agent. (36)

Although rubber and plastics compete for many markets, the trend toward using the two types of material in combination to achieve superior performance continues. (9, 37) A polyblend stock made by colloidal blending of polyvinyl chloride resin and butadiene-acrylonitrile rubber possesses properties heretofore obtained only by mill mixing. By varying the ratio of nitrile rubber and polvinyl chloride, products ranging from hard plastic materials to soft rubberlike compositions are produced. Thermoplastic tubing and hose can be made which are superior to plasticized elastomers in dimensional stability when aged at high temperatures and, in addition, are not subject to stiffening because of plasticizer extraction. Such tubing can be used for transferring beverages, gasoline, oils, solvents, and industrial chemicals.

Worn bowling pins can be used again when turned down and covered with 0.1-in. coating of resin-rubber compound (10)



Acrylonitrile-styrene copolymers are also used in combination with butadiene-acrylonitrile rubber for the production of tough plastics of high softening point. Such materials are employed to make lightweight tote boxes for the textile industry. Phenolic resins are likewise being compounded with styrene and acrylonitrile butadiene-type copolymers to materially increase hardness, toughness, abrasion and heat resistance, and surface finish. (38) Other reports pertaining to natural and synthetic rubbers described electrically conducting compounds, (39) organic polysulfides, (40) and rubber hydrochloride film. (41)

The production and variety of appplications of silicone polymers increased during the past year. (42, 43) Silicone elastomers (44-47) made by the condensation and oxidation of methylsiloxane are flexible at —65° C. and remain stable at 200° C. These characteristics make them useful at temperatures below and above those at which natural and synthetic rubbers can function. Their chemical resistance makes them desirable for gasket applications. Silicone electrical insulating resins (48) used in combination with such inorganic materials as mica, glass, and asbestos are responsible for the new A.I.E.E. Class H standard for insulated equipment which must withstand 180° C. at the hottest spot. Other developments in the silicone resin field include protective coatings, (49, 50) adhesives, (42) and molding compounds. (51)

The range of applications for nylon resins (52-55) continues to expand. The toughness of the material, its form stability, and the ease with which it can be formed into small precise shapes are characteristics aiding its adoption for industrial uses such as gear trains and bearings. Valve seats for high pressure oil and gas systems are also being molded from the rigid types of nylon. Flexible types are used as valve seals for aerosol bombs and refrigerator systems and as stem packing for oxygen cylinder valves. (21) Work gloves fabricated from nylon compounded with neoprene provide protection against tetraethyl lead and ethylene bromide. (56)

Especially noteworthy is the large number of reports publishing the results of investigations of new polymers. Among the types of resins studied were acrylics, (57-60) allyls, (61, 62) alkyds, (63, 64) arylphosphonic, (65) phosphonitrilic, (66) 9,10-epoxystearic acid, (67) β-propiolactone, (68) thiophene-formaldehyde, (69) furan, (70) and coumarone-indene. (71, 72) Another group of papers presented new information on polymerization reactions and techniques. (73-79)

The development of a flame-resistant cellulose acetate molding compound meeting Underwriters' Laboratories requirements was announced. (80, 81) This material is based on high acetyl cellulose acetate and is in use for electric mixer and shaver housings, blanket switches, vacuum cleaner parts, and the like. A product made by impregnating cotton fabric with cellulose nitrate and a fire retardant has found a wide variety of applications in the automotive, display, orthopedic device, and pattern making fields. (82) The properties of cellulose and its derivatives and plastic products were described. (83-88) New compounds were made from cellulose, (89) casein, (90) lactic acid, (91) and rosin. (92, 93)

The course of the reaction of phenols and formaldehyde (94, 95) and the effect of the structure of such resins on their properties were studied. (96) Aminoaldehyde resins and calcium sulfate were used to make a new casting composition which sets at room temperature and is characterized by low shrinkage and colorability. (97) It can be formed into dies which will serve to make accurate reproductions in copper or acrylic sheeting. Other reports described developments in melamine resins, (98) cold molding, (99) fiber fillers, (100) and coloring materials. (101) The mechanism of plasticization was reviewed (102) and new information on plasticizers for vinyl resins (103, 104) and other thermoplastics (105, 105a) was published.

A new sawdust-phenolic board made with 6 to 15% resin content was exhibited at the National Plastics Exposition. (1) This synthetic lumber appears to have considerable possibilities in the construction field and may soon be an important additional market for phenolic resin. (106, 107) Compreg, which is wood that has been impregnated with synthetic resin and cured under high pressure, was installed on the flight deck of an aircraft carrier and withstood 18,000 landings without evidence of harmful wear. (108)

Progress in the manufacture and application of low-pressure (109, 110) and thermoplastic (111) laminates was reported. Data were made available concerning the strength properties of laminates made with various reinforcing materials. (112-114) A sandwich material made by bonding aluminum sheeting to a balsa wood core with phenolic-elastomeric adhesive was used to make skis and aircraft stabilizers. (115) Other developments in metal-wood composites (116, 117) and paper-honeycomb structures (118) were reported. Plant equipment for impregnating paper with resin was described. (119) Another author reviewed grades, properties, fabrication, and applications of vulcanized fiber. (120)

German plastics

Further reports appeared concerning German industrial advances in plastics during World War II. The materials covered by these articles during the year included polyamides, (121, 122) a condensation resin made with cyclohexanone and methyl cyclohexanone, (123) polyethylenimine, (124) and polyvinyl chloride paste. (125) Two reviews described materials and applications developments (126) and continuous polymerization techniques. (127)

Molded silicone rubber packing for oil seal gives good performances at temperatures ranging as high as 400° F. (42)

Processing

Expansion in the extrusion molding sector of the industry stands out in the record of 1948. The modern practice of dry extrusion of plastics had its inception during the present decade; there were over 1300 such extruders in use in 1947 and it is estimated that this number will grow to 1800 by 1950. In the past two years, most of the new units went to custom extruders; currently a high percentage is going to proprietary extruders, such as packaging sheeting manufacturers, filament makers, and large independent consumers. Wire and cable coatings, gasket sheeting, film, and garden hose are among the large scale outlets for extruded material. (128-130)

A process for the extrusion of thin walled tubing to accurately controlled thickness and diameter was announced. (131) The usual extrusion die is connected to a cooling sleeve, the bore of which is etched to a matte surface, with an intervening Transite insulator and balanced air pressure to prevent sticking of the tubing to the sleeve. The process has made it possible to extrude tubing from 0.005 to 0.030 in. in wall thickness to a tolerance of ± 0.001 in. in thickness and ± 0.002 in. in diameter.

Stretch orientation of extruded polystyrene sheeting (132) and a drawing method for forming boxes from the oriented polystyrene (133) were described. Decorative or identifying markings can be applied to polyvinyl and polyethylene films by printing (134, 135) or hand painting (136) techniques. Fabricators of clear acrylic plastics have developed flame polishing with an oxy-hydrogen torch to produce an improved finish in less time than the usual sanding, buffing, and rouge polishing method. (137)

Turn to next page

Colloid treated fabric can be used for masks, helmets, etc., or to repair auto bodies and metal or wood patterns (82)

A comprehensive and detailed discussion of the problems involved in making molds for polyester casting (138) and in the casting process itself (139) was presented in two outstanding articles in the literature on this subject. Many types of rigid and flexible molds were dealt with in these and other reports. (140-142) Two new casting compounds composed of mixtures of resins and inorganic powders were announced. (97, 143) The embedment of materials in cast plastics received considerable attention. (144-146) Casting of phenolics was discussed in articles dealing with the use of split molds (147) and case hardening to restore a hard and strong skin to the machined plastic or to expand the casting to the predesigned size. (148) Polystyrene was reported to have advantages over wax in the centrifugal casting of metals by the "lost-wax" process. (149)

Several innovations in molding procedures were divulged during the year. Combination of two or more colors in a single molded piece without cementing or other fabricating operation has been accomplished by multiple-shot injection molding. (150) Speedometer faces, clock faces, radio dials, and fuel and temperature gages are made with dark background and white figures, letters, and other markings by this technique. A process known as Tridyne uses two stages of injection to transfer the molding material into the mold and thus assures fast, uniform heating, thorough mixing, and accurate moisture control. (151) A means of applying multicolored designs on the surfaces of thermosetting moldings right in the mold was developed. (152) An injection molding machine capable of molding 40 oz. of cellulose acetate compound or 32 oz. of polystyrene per cycle for use in the production of toilet seats, refrigerator parts, radio cabinets, and similar large area parts was announced. (153) Developments in duplex (154) and automatic (155) molding were described.

Further advances in the art of steam preheating, (156) induction heated molds, (157) high-frequency molding of wood products, (158) pulp molding, (159) and electronic welding of thermoplastics (160-163) were reported. A self-contained electrically powered steam generator has become available to supply high pressure steam right at the press. (164) Problems involved in removing flash debris by conveyor system, (165) tumbling plastic parts for cleaning and finishing purposes, (166) maintenance of valves in hydraulic press and heating equipment, (167) and providing fire protection in plants fabricating cellulose nitrate plastic (168) were discussed.

The techniques of post forming and the laminates made for shaping in this manner have been investigated and improved to keep pace with the growing market for these products in the aircraft, automotive, refrigeration, textile, electrical, and building fields. (169, 170) Developments in materials, processes, and equipment for molding low pressure laminates received significant attention in connection with the expansion of the Air Force. (2, 171) The design (172) and fabrication (173) of reinforced plastics were reviewed in other reports.

Applications

The first MODERN PLASTICS Competition held since 1941 revealed in a dramatic way the technical and economic progress that had been made by the industry during the war and the three years of reconversion.

In the building industry category recognition was given to vinyl flooring, (2, 174, 175) polystyrene partition blocks, (2) and a laminated plastic telephone booth. (2) Other developments in this field included acrylic wash basins, (176) vinyl sink traps, (177) phenolic sills, (178) silicone gaskets (179) for windows, and polystyrene wall tile. (180)

Vinyl upholstery and wall covering materials received an award in the furniture and interior decoration class. (2) Trends in the manufacture of furniture from plastics (181) and in the use of vinyl sheeting for covering chairs, desks, counter tops, and automobile interiors and seats (182-184) were reviewed.

Plastics in medical science provided artificial hands, legs, ears, noses, and other portions of the face and body with a remarkable simulation of the natural skin color and appearance. (2) An improved hearing aid incorporating 22 parts molded of five different plastics also received an award. Other developments in hearing devices included printed circuits on polystyrene (185) and a vinyl housing for the dry cell. (186) Additional applications of plastics

in medical equipment embodied transparent acrylic orthopedic braces, (187-189) a radiopaque vinyl tube for treatment of intestinal stoppages, (190) 18 phenolic parts in a diathermy unit, (191) and melamine laminates for doors, window sills, walls, counter tops, drawers, and hand rails in hospitals. (192)

The versatility of plastics was well illustrated in the winners in the musical instruments class; namely, an all plastic polystyrene harmonica and piano parts made of ethyl cellulose, phenolic, and cellulose nitrate plastics. (2) Many other musical instruments (193, 194) as well as radios (195, 196) employ plastic parts to advantage. Television represents a new and growing market for molded and fabricated items. (197, 198) Vinyl records are finding increased acceptance because they wear longer than shellac records, their reproduction quality is high, and they can be molded in short cycles. (199) A new sound-recording belt for portable dictating machines has been made of ethyl cellulose. (200)

The important packaging market for plastics was represented in the competition awards by the heat-sealed vinyl bag, modified with nitrile rubber, used for holding and mixing oleomargarine. (2) A noteworthy series of three articles surveyed the materials and applications of plastics in this field. (201-203) Other reports reviewed developments in containers made of polyethylene, (204-207) polystyrene, (208) vinyls, (209, 210) cellulose acetate, (211) pectinate, (212) and laminated wood. (213) The proofing of paper has expanded beyond mere waterproofing to include proofing against mold, flame, grease, and loss of strength when wet, using new impregnants, coatings, and combinations of plastic and elastomeric materials. (214-218)

A three-piece scale housing was outstanding among the store and business machine equipment entries. (2) A compehensive analysis of the use of plastics in competition with metals in this field was published. (219) The author notes that such characteristics as low density, dielectric properties, ease of fabrication, low thermal conductivity, high damping capacity, available transparency, and low unit cost in mass production make plastics attractive to the designer and engineer. (220, 221)

In the transportation category notable achievements were judged to be the use of silicone rubber gaskets in Diesel-electric locomotive engines and plastic laminates for the interior panels of station wagons. (2) Another award related to the same field recognized the successful commercial production of small boats by low pressure molding from glass mat, polyester resin, and cellular cellulose acetate. (2) Some of the advantages of plastic boat construction over existing conventional construction methods are an approximate 90% saving in man hours for hull construction or approximately a 45% reduction on the complete boat, 90% of the labor required can be unskilled, maintenance is minimized since there are no seams to caulk and fastenings to tighten, and painting is eliminated. (222) Other developments in plastics in transportation pertained to their use in glazing, (223, 224) batteries, (225) and miscellaneous parts (226-228) in automobiles and as tooling, (229, 230) materials of construction, (231, 232) glazing (233) and control panels (234) for aircraft.

The use of laminated phenolic bearings in a wide range of installations over a period of years has shown them to possess important properties which are significantly useful in many applications. These properties include longer life, greater ease of handling and installing, power saving due to lower friction, low-cost water lubrication, greater cleanliness of operation, better holding of gage due to less wear, and greater resistance to corrosion and decay. Among the applications may be mentioned bearings for ball mills, centrifugal pumps, water-wheel turbines, breakdown mills, and ship stern tubes. (235, 236)

Plastic parts in production or under development for textile machinery include bobbins, reels, spinning buckets, cloth roll bearings, laminated separators, tips for quills, binder posts and bushings, temple rolls, twisters, pickers, shuttles, and top rolls. Many of these items are being made with a phenolic molding compound containing cottonseed hulls as filler. (237) Developments in materials of construction for chemical plants and a detailed tabulation of their properties were presented in a comprehensive review covering metals, cements, ceramics, rubbers, fibers, wood, and plastics. (238, 239) Special applications for polyethylene, (240) polyvinyl chloride, (241) saran, (242) and acrylics (242, 243) in chemical operations were described.

Ion exchange resins are valuable new tools both in chemical plant engineering and in the laboratory. (244-247) They are being produced at the rate of

Cabinet of portable radio consists of a transparent thermoplastic material laminated to a colored fabric core (111)

Butyrate extruded over metal tubing is expected to find wide use in transportation, decoration, and the home (228)

8,000,000 lb. per year, and new uses are constantly being proposed. Numerous reports were published regarding the fundamental properties of ion exchange resins and the various factors affecting their performance. (248-255)

Optical applications of plastics were spotlighted in reports discussing lenses and spectacle frames, (256) cameras, (2, 257) luminescent and fluorescent compositions, (258, 259) and a portable planetarium. (260) The electrical uses were highlighted by several reviews covering switchgear, (261) insulation for wires and cables, (262-266) and design of electrical equipment. (267) The announcement that plastic electrets (268) are nearing successful industrial development portends an interesting new outlet for plastics; an electret is a permanently electrified product produced by allowing a molten wax or resin to solidify in an electrical field.

The coatings industry reported advances in the use of resins for protection of metal, (269) strippable finishes, (270, 271) and inks. (272) Other noteworthy applications of plastics described during the year included refrigerator parts, (273, 274) balloons for exploring the stratosphere, (275) safety equipment, (276) resin-bonded diamond wheels, (277) foundry casting compound, (278) nylon rope, (279) toys, (280) buttons, (281) collar stiffener, (282) brushes, (283) laminated traffic signs, (284) and lawn mower parts. (285)

Adhesives

The fundamental nature of the adhesion of materials received growing attention which augurs well for the advancement of this branch of the plastics industry. Adhesion to glass, (286) metal, (287) cellulose, (288) and plastics (289) were studied. The properties of resorcinol-formaldehyde (290) and urea formaldehyde (291) adhesives were reviewed. Other authors dealt with problems involved in bonding metals, (292) wood, (293-295) and various materials. (296, 297)

Properties, testing, specifications

The great expansion in the range and volume of application of plastics since 1941, which has been the keynote of this survey, can be attributed in part to the effort which was expended during the war period to obtain engineering data on the properties and performance of plastics. The designer, engineer, manufacturer, and consumer will use more and more plastics when the background of knowledge and experience regarding their behavior under service conditions instills confidence in their reliability.

One of the great needs of the war period was the accumulation and organization of technical data regarding the properties of plastic materials. Action was initiated on several fronts to meet this demand of the military agencies for engineering data on plastics. The S.P.I. Engineering and Technical Committee set up 10 task groups to collect and collate information on the design and fabrication of plastic parts, which has formed the basis of the "SPI Handbook." (298) The Plastic Materials Manufacturers Association undertook the compilation of "Technical Data on Plastics," which first appeared in booklet form in 1943 and was issued in its third edition during 1948. (299) The Laminated Products Section of the National Electrical Manufacturers Association launched a comprehensive investigation of the properties of laminates at Johns Hopkins University, the results of which were assembled in 1945 in a report entitled "NEMA Laminated Plastics Test Project at Johns Hopkins University" and were summarized in an article published recently. (112) Committee D-20 on Plastics of the American Society for Testing Materials took on the assignment of preparing specifications for plastic materials as well as stepping up its activities in developing standard methods of testing; the book of "A.S.T.M. Standards on Plastics" was published in 1943, and a third edition appeared in 1948. (300)

In retrospect, the fact stands out that although valuable and timely service to the war effort was supplied by these various groups, nevertheless the job of getting together this engineering information was a tedious and time-consuming one. It leads us to the inescapable conclusion that we must concentrate on doing our research and development before and not after our need is greatest.

Extensive additions were made during the past year to the literature on the sorption and permeation of water vapor and other gases by and through plastics. These studies included fundamental research on these phenomena (301-307) and applied research in relation to the use of plastic films and sheeting for packaging, (308-313) electrical, (314) and chemical purposes. (56) Reports also appeared

(*Please turn to page* 155)

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General

MATERIALS OF CONSTRUCTION. Ind. Eng. Chem. *40*, 1773-1936 (Oct. 1948). This annual review section consists of 12 articles. Four of them on elastomers, fibers, plastics, and hard rubber are concerned with the plastics industry and closely related fields. Data on properties are presented in tabular form. There is a large number of references.

PLASTICS — A NEW EDUCATIONAL FIELD. L. F. Rahm. SPE News *4*, 7, 13 (Sept. 1948). The types of educational opportunities and the needs for education in the plastics field are discussed.

ADHESIVES, TOO, ARE FASTENERS. Electrical Mfg. *42*, 94-9, 166, 168, 170, 172, 174, 176 (July 1948). The theories, classes, properties and applications of plastics are reviewed.

Materials

PREPARATION AND PROPERTIES OF ETHYL VINYL KETONE AND OF METHYL ISOPROPENYL KETONE. E. M. McMahon, J. N. Roper, Jr., W. P. Utermohlen, Jr., R. H. Hasek, R. C. Harris, and J. H. Brant. J. Am. Chem. Soc. *70*, 2971-7 (Sept. 1948). The syntheses of ethyl vinyl ketone and methyl isopropenyl ketone by independent routes are described. Peroxide-catalyzed mass polymerizations were made with the two monomers and with mixtures of the two. Polymethyl isopropenyl ketone was clear, colorless, and hard. Polyethyl vinyl ketone was clear, slightly yellow and quite soft, and formed at a much faster rate than its isomer. In copolymerizations it was observed that the higher the ethyl vinyl ketone content of the monomer mixture, the faster was the polymerization rate and the softer was the product.

POLYISOBUTYLENE IN WAXES. W. L. Abramowitz. Modern Packaging *21*, 159-62, 176 (June 1948). The properties of blends of polyisobutylene with refined paraffin and microcrystalline wax are reported.

Applications

POLYVINYL ALCOHOL AS AN EMULSIFYING AGENT. G. F. Biehn and M. L. Ernsberger. Ind. Eng. Chem. *40*, 1449-53 (Aug. 1948). Polyvinyl alcohols were compared with commonly used dispersing agents in the preparation of aqueous dispersions of mineral oils, vegetable oils, and other organic liquids. The most effective polyvinyl alcohols were found to be high-viscosity products hydrolyzed to the extent of 75 to 80 percent. Certain of the polyvinyl alcohols were very effective over a wide pH range, but were adversely affected by the presence of salts.

WET STRENGTH OF PAPER. I. Bursztyn. British Plastics *20*, 299-304 (July 1948). Microphotographs of wet strength paper show that melamine resin is deposited more uniformly than urea resin. The particles of melamine resin are usually smaller in diameter than that of the fiber. The efficiency of the melamine resins in increasing the wet strength is much more than that of the urea resins, particularly with bleached furnishes.

Properties

REFRACTOMETRIC DETERMINATION OF SECOND-ORDER TRANSITION TEMPERATURES OF ACRYLIC, VINYL HALIDE, AND STYRENE POLYMERS. R. H. Wiley and G. M. Brauer. J. Polymer Sci. *3*, 455-61 (June 1948). A refractometric method for determination of second-order transition temperatures of polymers is extended to include a series of polymers for which the transition occurs between 0 and 75° C. Refractive index data within ± 30 to 50° C. of the transition temperature are given for some acrylate, methacrylate, vinyl chloride, vinylidene chloride, and styrene polymers and copolymers. These data show discontinuities which locate the second-order transition temperatures for these polymers. Deviation from the linear relation near the transition temperature is related to a time effect.

RHEOLOGY OF PLASTIC SOLIDS. G. W. S. Blair. Proc. Univ. Durham Phil. Soc. *10*, 468-85 (1948). The rheology of plastics is reviewed; 290 references.

Chemistry

MOLECULAR STRUCTURE AND ITS INFLUENCE ON THE PROPERTIES OF PHENOLIC RESINS. N. J. L. Megson. J. Soc. Chem. Ind. *67*, 155-60 (1948). From a consideration of molecular dimensions and bond angles, it is deduced that a Novolak resin must consist of highly kinked, assymetrical molecules. As a result, it is concluded that such a resin, when hardened with "hexa," will contain much less than the theoretically possible number of cross-links. A hardened resin will have a sponge-like structure which can explain, partially, certain physical and chemical properties. Phenol-methylene resins derived from formaldehyde are contrasted with phenol-ethylene resins, which can have a symmetrical structure. An explanation is given for the good "tack" producing properties of Koresins, based on this symmetry. It is advocated that attention should be given to the synthetic method, as opposed to the analytical procedure hitherto used in investigating Novolaks. The importance of the synthetic approach is stressed, because of the comparative lack of information on crystalline intermediates. Finally, other methods of attack are outlined, including the desirability of studying the fine structure of simple phenol-formaldehyde condensation products.

ANIONIC CHAIN POLYMERIZATION. R. G. Beaman. J. Am. Chem. Soc. *70*, 3115-18 (Sept. 1948). Polymerization of methacrylonitrile by means of butylmagnesium bromide, phenylmagnesium bromide, triphenylmethylsodium, and sodium in liquid ammonia was effected. Sodium dissolved in liquid ammonia gives immediate and complete reaction at —75°. Evidence is presented to show that these polymerizations proceed by an anionic chain mechanism.

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ROSIN ESTER RESINS. J. B. Rust and W. B. Canfield (to Montclair Research Corporation and Ellis-Foster Co.). U. S. 2,447,367, Aug. 17. A soluble resinous rosin polyhydric alcohol ester reacted at 200 to 300° C. with a saturated polymer of an alpha-unsaturated acid compound or ester thereof.

VINYL RESIN SOLUTIONS. B. de Supinski (to Glenn L. Martin Co.). U. S. 2,447,398, Aug. 17. Gamma polyvinyl chloride resin solution is prepared by forming a slurry by agitation of a mixture of particles of resin, plasticizer, and solvent; heating to cause penetration; cooling and stagnating to promote swelling; and heating until a clear liquid is formed.

HYDROCARBON RESINS. N. W. Furby (to California Research Corp.). U. S. 2,447,404, Aug. 17. Polymer bottoms from naphtha distillation are extracted with two selective solvents to dissolve color bodies, separating the extract, and recovering air-drying petroleum hydrocarbon resin.

COATING AND IMPREGNATION. L. J. Jubanowsky (to Baker Castor Oil Co.). U. S. 2,447,506, Aug. 24. A solid, fusible impregnating and coating composition comprising a mixture of a solid fatty acid ester and a polyhydric alcohol and a blown unsaturated ester of a polyhydric alcohol and an acid derived from a vegetable oil.

WOOL TREATMENT. J. B. Rust (to Montclair Research Corp.). U. S. 2,447,538-9-40, Aug. 24. Wool is shrinkproofed by heating in an aqueous solution of butadiene polymer or copolymer thereof with a methacrylate ester or acrylate ester.

PLASTIC STRUCTURE. R. N. Sabee and C. S. White (to R. N. Sabee, C. S. White, F. A. Grady, C. F. Meroni, and V. S. Lilly). U. S. 2,447,541, Aug. 24. Applying to a metallic cathode an electrically resistant material to form a discontinuous metallic pattern depositing on the interrupted pattern a metal, embedding the deposit, in a plastic and stripping the plastic and metal from the cathode.

METHYL PENTADIENE RESINS. J. T. Calfee and R. M. Thomas (to Standard Oil Development Co.). U. S. 2,447,610, Aug. 24. A nonflammable solid resin is prepared by polymerizing 2-methyl-pentadiene-1,3 at −10 to −160° C., adding a Friedel-Crafts catalyst dissolved in a halogenated alkane, dissolving in benzene or toluene and adding a halogenating agent.

SILOXANES. W. R. Collings, H. N. Fenn, and H. J. Fletcher (to Dow Corning Corp.). U. S. 2,447,611, Aug. 24. Phenyl and methyl substituted silicon compounds are reacted with silicon trichloride.

UREA MOLDING COMPOSITION. L. Smidth. U. S. 2,447,621, Aug. 24. A dry free-flowing molding powder comprising granulated urea-formaldehyde condensate, a cellulose filler, and a urea-formaldehyde-alcohol condensate flow promoter.

BUTADIENE POLYMERS. J. B. Rust and C. W. Pfeifer (to Montclair Research Corp.). U. S. 2,447,772, Aug. 24. Wool is shrinkproofed by treating in a stable emulsion of butadiene polymer.

VINYL RESINS. J. D. Ryan and F. B. Shaw, Jr. (to Libbey-Owens-Ford Glass Co.). U. S. 2,447,773, Aug. 24. A polyvinyl acetal ketal resin prepared by reacting polyvinyl acetal with a saturated aliphatic ketone.

BIREFRINGENT FILM. E. E. Barr and C. D. West (to Polaroid Corp.). U. S. 2,447,790-2, Aug. 24. A solid birefringent film of a solid material containing an intimate mixture of particles of isophthalic acid and terephthalic acid.

BIREFRINGENT FILM. M. Hyman, Jr. (to Polaroid Corp.). U. S. 2,447,805, Aug. 24. An optical element comprising a supporting surface and a solid film containing a mixture of isophthalic acid and terephthalic acid crystals.

RESINOUS NITRILE POLYMERS. D. T. Mowry (to Monsanto Chemical Co.). U. S. 2,447,810-1-2-3, Aug. 24. Polymerizable mixtures of a vinyl aromatic compound with maleodinitrile; 1,2-dicyano-1-chloroethylene; 1,2-dicyano-1-methylethylene, or 1,2-dicyano-1-phenylethylene.

WOOL TREATMENT. J. B. Rust (to Montclair Research Corp.). U. S. 2,448,004-5, Aug. 24. Wool fibers are shrinkproofed by treating in a bath containing chloroprene-alkyl methacrylate copolymer or chloroprene-alkyl acrylate copolymer.

ION EXCHANGE. G. B. Heusted and W. C. Bauman (to Dow Chemical Co.). U. S. 2,448,029, Aug. 31. Ion-exchange resins prepared by reacting with phenol sulfuric acid.

MOLDING. F. F. Olson and F. J. MacDonald (to B. F. Goodrich Co.). U. S. 2,448,114, Aug. 31. Method of molding composite articles of fabric and heat-formable resin.

COUMARONE-INDENE. H. M. Stanley, F. E. Salt, and J. F. Williams (to Distillers Co., Ltd.). U. S. 2,448,127, Aug. 31. Method of removing halogen from coumarone-indene polymers.

EXPANDED PLASTICS. H. H. Richmond and T. Tomiuk (to U. S. Rubber Co.). U. S. 2,448,154, Aug. 31. A symmetrical xenyl triazine is mixed with an organoplastic; the mixture is heated to 120 to 140° C.; release of nitrogen causes expansion.

HOLLOW ARTICLE. F. V. Cowan. U. S. 2,448,173, Aug. 31. Method of forming a hollow article from thermoplastic sheet.

DISPLAY. O. M. Arnold. U. S. 2,448,244, Aug. 31. An illuminated display unit containing a light conducting unit of methyl methacrylate resin.

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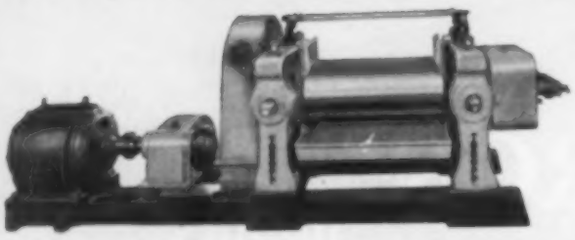

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VINYL COMPOUND. R. S. Barker and L. N. Whitehill (to Shell Development Co.). U. S. 2,448,246, Aug. 31. Vinyl alloxy acetate and polymers thereof.

ALKYD RESINS. T. W. Evans and D. Adelson (to Shell Development Co.). U. S. 2,448,258, Aug. 31. A convertible resin prepared by heating in inert atmosphere, a di-acid or anhydride thereof with a mono-alkenyl glycerol ether in the presence of kerosene.

VINYL ETHERS. N. W. Flodin (to E. I. du Pont de Nemours & Co., Inc.) . U. S. 2,448,260, Aug. 31. Resin prepared by reacting polyvinyl alcohol with dihydropyran in the presence of an acid catalyst.

FORMING METHOD. M. P. H. Peterson (to Goodyear Aircraft Corp.). U. S. 2,448,274, Aug. 31. Apparatus for centrifugally forming plastic sheet into a canopy, etc.

MOLDING. W. S. Renier. U. S. 2,448,277, Aug. 31. Apparatus for forming and preheating slugs of moldable material.

FINISHING. I. L. Lesavoy. U. S. 2,448,316, Aug. 31. Apparatus for subjecting the surface of plastic sheets to agitated sand.

RESIN. G. Widmer and W. Fisch (to Ciba Products Corp.). U. S. 2,448,338, Aug. 31. Condensates of an alcohol, an amino-triazine, and formaldehyde which are useful in lacquers and varnishes.

PANEL FACING. K. A. Craig and R. J. Auchter (to Paper Patents Co.). U. S. 2,448,357, Aug. 31. Facing sheets prepared by loading a face layer of paper with a thermosetting resin, coating a side of an anchor layer of paper with a high viscosity thermosetting resin, assembling with the uncoated side of the anchor layer on the outside, assembling under heat and pressure to cure the resin whereby a non-resinous outer paper layer is obtained which can be subsequently adhesively bonded to wood.

POLYVINYL ALCOHOL. C. Dangelmajer (to Resistoflex Corp.). U. S. 2,448,358, Aug. 31. A solid extrudable composition of polyvinyl alcohol, polyhydric alcohol plasticizer, and phthalic anhydride.

SILICON RESIN. J. J. Pyle (to General Electric Co.). U. S. 2,448,391, Aug. 31. An interpolymer of styrene and tetra-allyl silane.

METAL COATING. A. A. Schilling and W. L. Finlay (to Remington Arms Co. Inc.). U. S. 2,448,397, Aug. 31. A steel cartridge case with an undercoat of a phosphate, a coat of furfuryl alcohol resinified with phosphoric acid, and a wax over coat.

FILM. C. R. Irons and C. E. Sanford (to Dow Chemical Co.). U. S. 2,448,433, Aug. 31. Method of preparing wrinkle-free vinylidene chloride film.

THERMOPLASTIC SHEET. R. Mayne (to Goodyear Aircraft Co.). U. S. 2,448,492, Aug. 31. Apparatus for forming bubbles and like articles by centrifugally treating thermoplastic sheet material.

PHOTOGRAPHIC ELEMENTS. C. F. Glick (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,448,525, Sept. 7. A photographic element comprising a support, a polyvinylpyridine sublayer, and layers of synthetic hydroxylpolymer.

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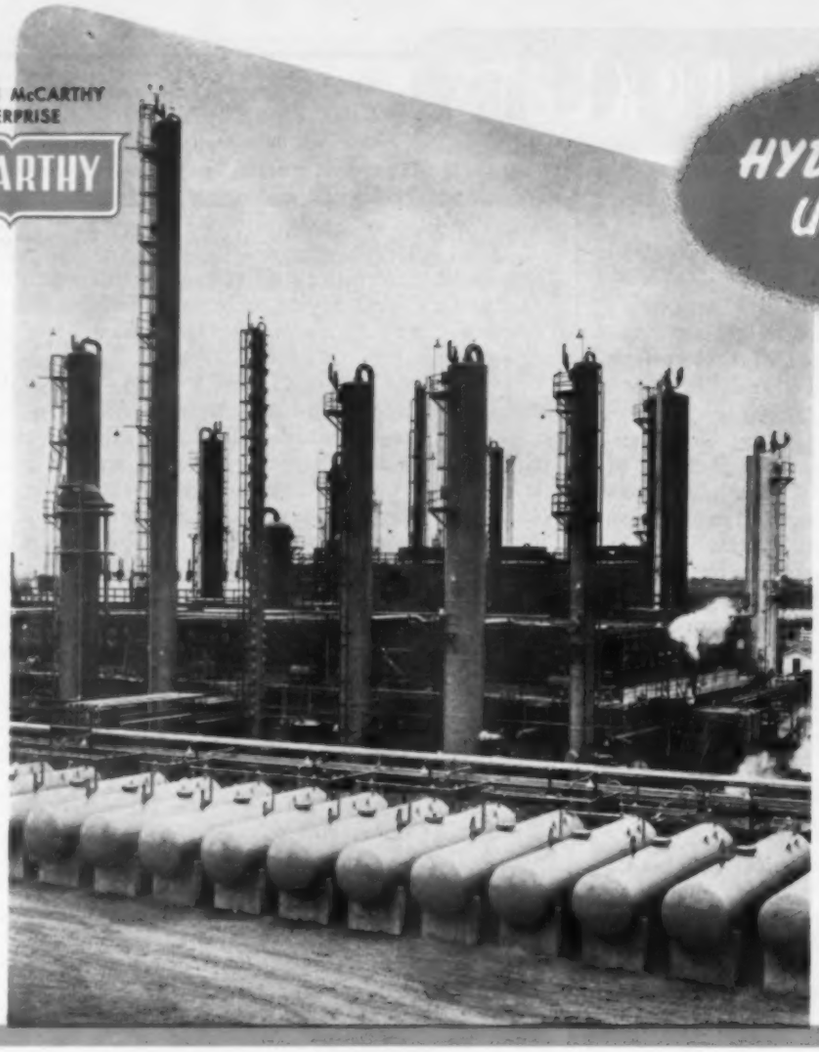

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BOOKS AND BOOKLETS

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery

Magnetic pulleys (Catalogs C-1001A and C-1007A)—The first catalog, C-1001A, describes the company's electromagnetic pulleys. The purpose, operating principle, advantages, and design features of the various types are discussed. Complete capacity and dimension tables are given in the eight-page catalog on pulleys ranging in size from 12 by 12 in. to 48 by 60 inches. The second catalog, C-1007A, presents the features of the new Perma-Pulley. The operating principle is explained and the advantages of non-electric construction are listed as are also practical applications for the pulley, which is made in 76 standard sizes with shaft diameters to suit any requirement. *Dings Magnetic Separator Co., 4740 W. McGeogh Ave., Milwaukee 14, Wis.*

Plexene molding powder—This 11-page, two-color booklet presents a detailed explanation of this new modified polystyrene powder for injection molding. Included is a list of properties. *Rohm & Haas Co., Washington Sq., Philadelphia 5, Pa.*

Chlorine—The second of a series of technical data books, this 72-page technical manual presents charts, diagrams, and illustrations concerned with the production and handling of chlorine and its end-products. Highlights in the history and growth of the industry, methods of manufacture, handling and unloading, safety precautions, shipping, equipment, and construction materials are among the many topics. *Pittsburgh Plate Glass Co., Fifth Ave. at Bellefield, Pittsburgh 13, Pa.*

Rotogravure printing—This eight-page booklet briefly compares gravure with other conventional printing processes and in some detail discusses cylinders, pressure rolls, doctor blades and ink. *Gotham Ink & Color Co., 5-19 47th Ave., Long Island City 1, N. Y.*

All-hydraulic presses for metal working and process industries (Bulletin 4804)—This 11-page bulletin brings to the trade an up-to-date review of the complete H-P-M line, including production units for the plastics industry—injection, compression, and transfer molding presses. Each type of press is described and illustrated and a listing is given of the sizes in which they are built. *The Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.*

Parlon—properties and uses—Information on the use of Parlon—chlorinated rubber—in printing inks, protective coatings, textile finishes, paper coatings, and other applications is presented in this revised 44-page technical booklet. Starting formulas for Parlon paper coatings and a table listing materials that are useful with Parlon in paper lacquers are included. Also presented is technical information on the general properties of the material. *Hercules Powder Co., Wilmington, Del.*

Modern plastic extruding equipment (Bulletin No. MP 10)—Various types of extruders manufactured by the company are illustrated in this four-page bulletin. A detailed description and a complete list of specifications accompany each illustration. Also included are illustrations and descriptions of conveyors, orientation units, granulators, and drying cabinets. *Modern Plastic Machinery Corp., 15 Union St., Lodi, N. J.*

Celoron silent gears (Catalog CG 28)—This seven-page catalog on Celoron, a high-strength, non-metallic, thermosetting plastic, which is used in the manufacture of silent gears, describes the material and its properties. It lists the standard forms and sizes that the material comes in and gives recommended practices for machining Celoron gears. Included are tables giving gear and gear tooth data and horsepower rating per in. of gear face. *Continental-Diamond Fibre Co., Newark, Del.*

Colpres 10—The properties of Colpres 10, a new, quick setting, room temperature, urea resin adhesive for the wood working industries, are presented in this seven-page booklet. Included is a sheet giving price and terms of sale, instructions for mixing the adhesive, description of its curing temperature range, and a list of typical hardwood products for which the resin is recommended. *Timber Engineering Co., 1319 18th St., N.W., Washington 6, D. C.*

Two quizzes on management skill—Supervisors, foremen, and higher executives can test their knowledge of management principles with these two self-analysis booklets. The first quiz, entitled "What's Your Management I.Q.?" is designed to enable executives to appraise their knowledge of managerial principles and their ability to train and lead workers. The test was compiled by Ellis H. Wooley, training supervisor, Naval Supply Depot, Oakland, Calif. The second quiz, "Self-Analysis Quiz for Supervisors and Executives," is a longer test for higher-level supervisors and executives. Those who aspire to such positions can score themselves on knowledge of executive work. This quiz was prepared by Rexford Hersey, associate professor of industry, University of Pennsylvania. Copies of these quizzes are available at 20¢ each for the first mentioned booklet and 25¢ each for the second. Order from the *American Management Associations, 330 W. 42nd St., New York, N. Y.*

A valuable name is worth protecting—This six-page booklet explains the problem faced by manufacturers whose trade names, through widespread and indiscriminate usage, finally become generic. Included is a list of four do's and don'ts for using this company's trade marks. *The Formica Co., Cincinnati, Ohio.*

Enco lathe turrets (Catalog No. 48)—This 16-page catalog presents illustrations of typical applications of turrets on actual jobs. Among the new models shown in the catalog is the Enco Carriage Hexturret that is now available for lathes that have a swing of from 9 to 32 inches. Included in the catalog are turret selection charts for particular lathes. *The Enco Mfg. Co., 4522-24 West Fullerton Ave., Chicago 39, Ill.*

Schmieg centri-merge spray booths (Catalogues No. 480 and 481)—The first catalog, No. 480, describes the company's centri-merge spray booths for the elimination

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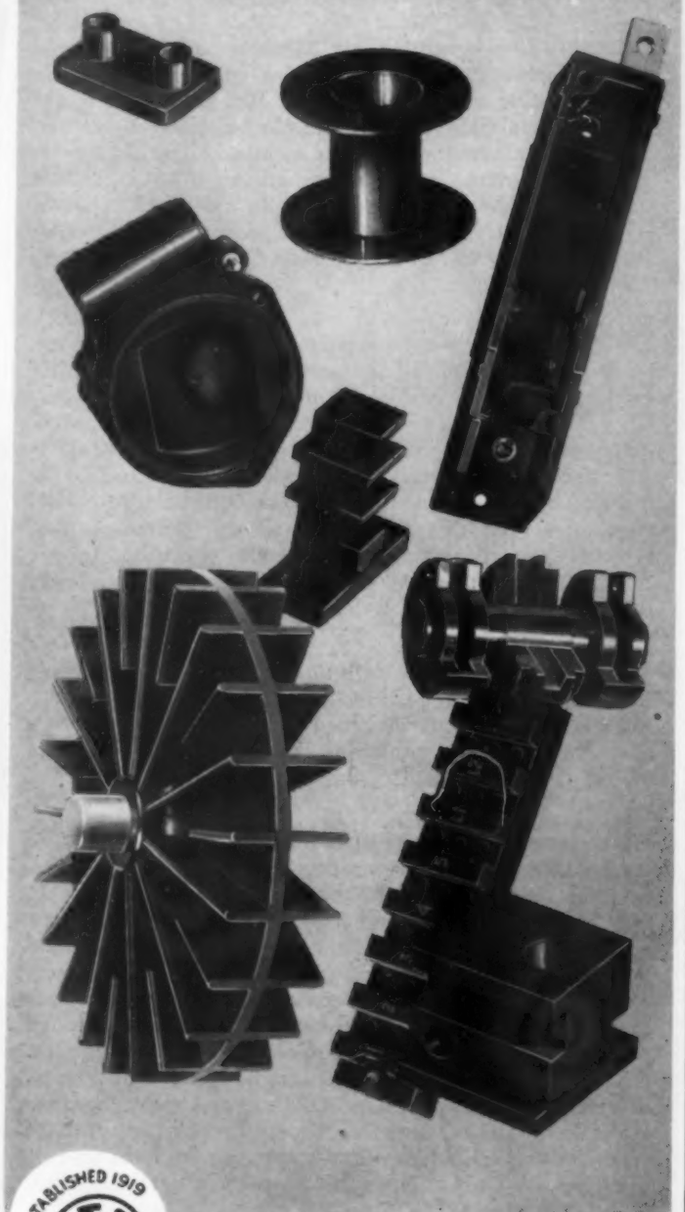

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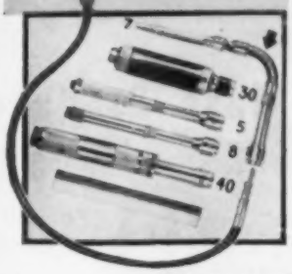

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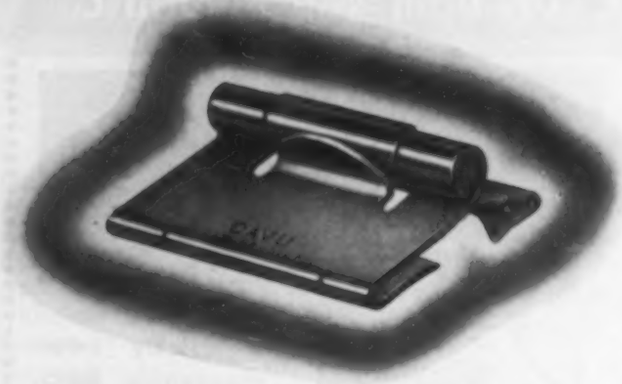

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of paint overspray. Included are photographs and blueprint reproductions of typical plant installations. The second catalog, No. 481, offers information concerning equipment that is manufactured by the company. Included are descriptions of dust and fume control units, spray booths, mechanical washers, industrial ovens, and sheet metal equipment and accessories. Tables of technical information for plant managers and engineers are also given. *Schmieg Industries, Inc., 385 Piquette Ave., Detroit 2, Mich.*

Industrial dust control—This 23-page bulletin contains information on the basic principles which apply to the control of dust in industrial plants. Reasons why a dust-free industrial plant is an economic asset are presented, along with information on how to attack dust problems. Engineering data, including dimensions and capacities of Sly dust filters, are presented, followed by a list of over 100 different kinds of dust which are collected by the Sly filters. *The W. W. Sly Mfg. Co., 4700 Train Ave., Cleveland 2, Ohio.*

Electronik potentiometers—Catalog No. 15-13 discusses, in 32 illustrated pages, the constructional features and operating principles of certain electronic instruments, including the Electronik strip chart electric control potentiometers, strip chart and circular chart controllers and recorders, precision indicators, indicating controllers, and thermocouple and Radiamatic assemblies. Also presented are tables of various control forms, typical control systems, and style selection tables. *The Brown Instrument Co., Wayne & Roberts Aves., Philadelphia 44, Pa.*

Ten answers to your fatigue testing problems—This four-page bulletin describes 10 different fatigue testing machines that are designed for application to solving almost any fatigue problem. *The Baldwin Locomotive Works, Philadelphia 42, Pa.*

Durez check chart—This handy chart, in slide rule form, is designed as a reference for engineers, designers, molders' representatives, etc., who have occasion to specify plastic materials. The chart covers only the company's phenolic materials for a number of typical applications. As the slide is pulled to the desired application, the company's recommended material number appears in one of the cut-out windows and typical physical property figures appear near this number. On the back of the chart are engineering tables, such as temperature conversion, weights, and cubic equivalents. In addition, the slide shows specific gravities of various structural materials for comparison with specific gravities of Durez. *Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y.*

Your plastic product . . . and Amos—A resume of the company's facilities and finished products is presented in this attractive 48-page booklet which is divided into three main sections. The first section emphasizes engineering and product development. Full-color illustrations of end products, including a re-use candy container, housings for razors, vacuum cleaner parts, and toys, point up this work. The second section is devoted to the company's equipment—its design, mold making, molding, and finishing services. Advantages of injection molding are given in the last section, which also presents basic engineering and design information; characteristics of thermoplastics; an informative guide on how to buy plastic parts; and charts and tables on

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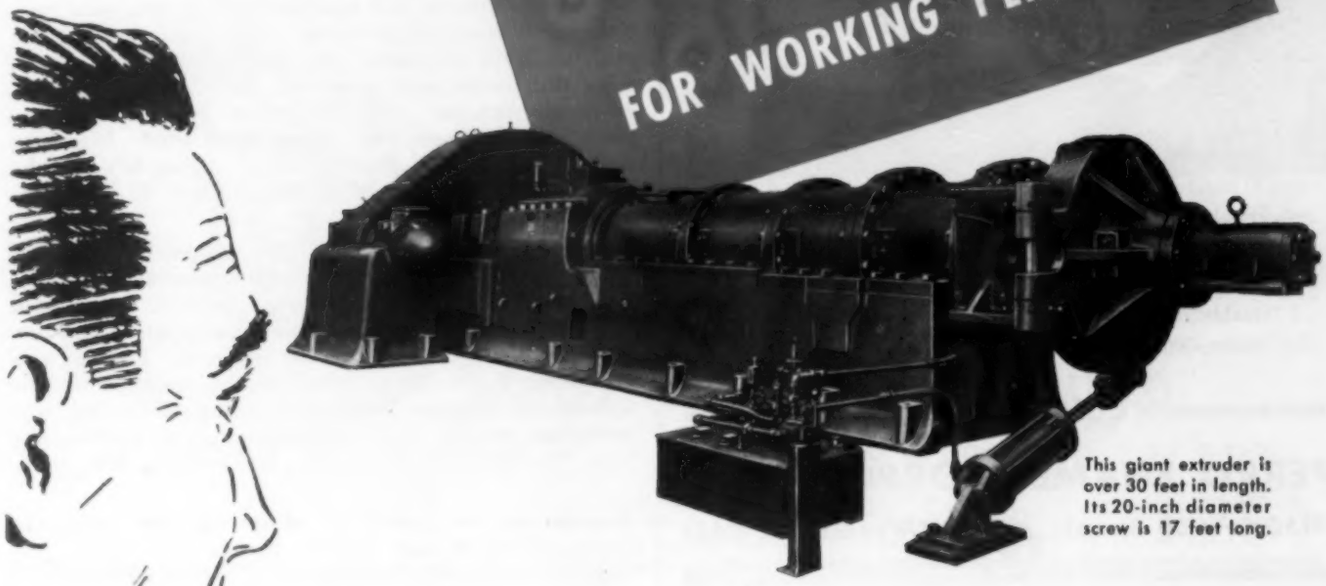

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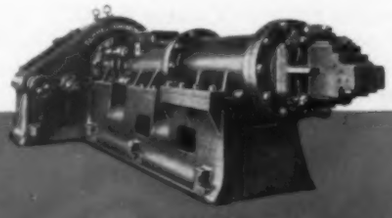

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plastics molding materials. *Amos Molded Plastics, Div. of Amos-Thompson Corp., Edinburg, Ind.*

Electronic controls (Bulletin Z6500)—This four-page bulletin describes and illustrates the following instruments manufactured by the company: recorders, controllers, indicators, combustion safeguards, and thermocouples and selector switches. Included with the bulletin is a separate price chart. *The Wheelco Instruments Co., Harrison & Peoria Sts., Chicago 7, Ill.*

Fourteen-in. South Bend precision drill press (Catalog No. 400)—Features and specifications of this new precision drill press are presented in the eight pages of this bulletin. Both the bench and floor models are shown. Also illustrated and described are motors, controls, extra spindles, and other drill press accessories. Complete specifications and prices are listed. Diagrams show dimensions of the drill press. *South Bend Lathe Works, 343 East Madison St., South Bend 22, Ind.*

Marvinol VR-10 vinyl resin—The properties and uses of Marvinol VR-10, together with processing methods, are presented in this eight-page booklet. Also listed are typical formulations and plasticizers and stabilizers used in the processing of the material. Typical uses of Marvinol VR-10, as cited in the booklet, include upholstery, luggage, industrial tubing, floor and wall coverings, shower curtains, wire and cable jackets, and toys. *The Glenn L. Martin Co., Baltimore 3, Md.*

Instruments for treatment of sewage and industrial wastes—This 44-page booklet has been compiled primarily to acquaint plant engineers, superintendents, and operators with the many applications of measuring and controlling instruments to sewage and waste processes. Some of the applications covered include sewage flow, bar screen automatic operation, dryer temperature, pH measurement, chemical mixing basin, and boiler plant instrumentation. Each application is accompanied with a schematic diagram. Among the instruments described are electric and mechanical flow and liquid level meters, pressure gages, water circulators, and pneumatic remote transmission systems. *The Brown Instrument Co., Wayne & Roberts Aves., Philadelphia 44, Pa.*

For production—veneers, plywood, and laminated wood—Printed in three colors, this brochure illustrates and describes the company's multiple-opening steam platen hydraulic press for the automatic production bonding of 50 by 100-in. plywood, the multiple-opening platen press designed to process hard synthetic building board panels ⅛ to ½ in. thick, the up-working platen press for the manufacture of composition building board, and the 10-opening, multiple-cylinder platen press for manufacturing hard board building panels. *The R. D. Wood Co., Public Ledger Bldg., Philadelphia 5, Pa.*

L & N pneumatic control (Catalog ND4B)—A complete, air-actuated control system of advanced design is presented in this 24-page booklet. The equipment described is said to be enabling users in the oil, chemical, and other industries to obtain faster start-up, smaller process swings, no process drifts, and shorter turnaround time. Diagrams and test curves show how the system provides proportional action, automatic droop-correction (reset), and stabilized rate action. Included in the booklet are descriptions of a complete line of L & N controllers. *The Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia 44, Pa.*

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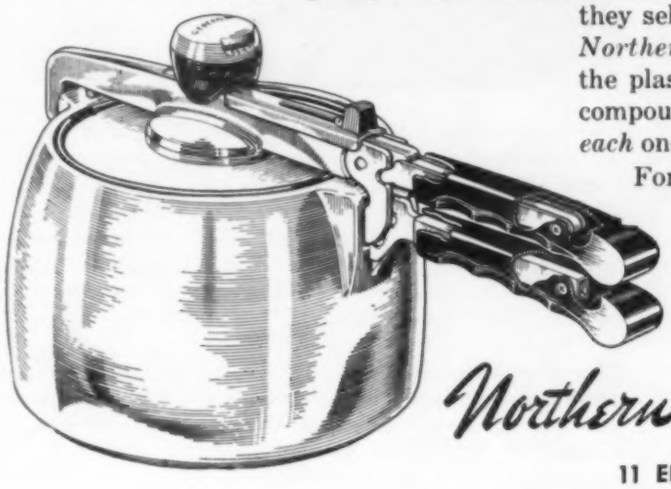

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Rotary type press—F. J. Stokes Machine Co., 5934 Tabor Rd., Philadelphia 20, Pa., is now offering a fully automatic 15-ton capacity rotary type press for high speed cold molding. It will take pieces up to a maximum diameter of 1 7/16 in. and maximum die fill of 2 1/16 inches. In the event of overload, a safety release and pressure equalizer prevent jamming and undue strain. Adjustment for pressure, thickness of the piece, and speed of the press can be made during press operation.

Two-ounce injection press—An all-hydraulic 2-oz. injection press for vertical or horizontal operation has been announced by Moslo Machinery Co., 2443 Prospect Ave., Cleveland 15, Ohio. It can be furnished for molding nylon and vinyl, as well as other thermoplastic materials. A three-way heat nozzle heater is furnished on the nylon unit and is optional equipment on standard machines. Capacity of the hydraulic pump is 7 g.p.m. Other specifications include: mold size of 8 by 9 in.; mold thickness 6 in.; mold opening 6 in., injection plunger 1¼ in. diameter; and stroke 7 inches. Injection pressures on the standard machine go to 16,250 p.s.i. Special injection cylinders and pistons are available for pressures up to 26,000 p.s.i.

Pyrometer—Cole Instrument Co., 1320 S. Grand Ave., Los Angeles 15, Calif., is offering Model 104, a wall mounting type pyrometer designed for use with plastic molding equipment, die casting machines, heat treating and annealing furnaces, ovens, etc. The unit can be supplied with calibrations ranging from 0-300° F. to 0-3000° F., or Centigrade equivalents. In the lower ranges automatic cold end compensation is furnished to eliminate errors caused by variations in room temperature terminals.

Sander—For finishing small parts too large to be deburred by tumbling, Merit Products, Inc., 4373 Melrose Ave., Los Angeles 27, Calif., has introduced a small sander, Model 300D. It consists of an aluminum body which houses a cartridge of abrasive cloth resting on six replaceable brushes. When the wheel is rotated the brushes cushion the abrasive and mold it to the work shape. The shank is bored to fit either a ½ or ⅝-in. shaft. The sander may be used on most home power tools, portable hand drills, flexible and motor shafts.

Standard abrasion testing set—Taber Instrument Corp., 136 Goundry St., North Tonawanda, N. Y., has added a standard abrasion testing set designated as Model No. 100-109 to its line of standard rub-wear testers. This line's rotary abrading action has been incorporated in the new set which takes 4-in. specimens. Various abrasive wheels for testing all types of surface finishes are available. A variable controlled suction pump with vertical dust receiver and adjustable swinging nozzle is featured. The control panel is equipped with an adjustable timer which provides a test period of 1000 cycles or less. An additional abraser unit can be located outside and connected with the control unit, thereby permitting two specimens to be tested simultaneously using the same controls and vacuum unit.

Elevating table—A standard 4000-lb. capacity hydraulic elevating table has been added to the line of such tables put out by Lyon-Raymond Corp., 6787 Madison St., Greene, N. Y. With a 30- by 30-in. top which can be lowered to 28 in. or elevated to 42 in., it can be used for die handling; for positioning work at a convenient working height for welding, grinding, die repairing, and other bench jobs; or can serve as a modified sheet feeding table for handling heavy sheets. Two heavy duty ball bearing swivel casters and two heavy duty rigid casters with 6-in. wheels and roller bearings provide portability under full load. A floor lock type brake holds the table in position when required. The table has a single speed hydraulic foot pump which develops 1000 p.s.i.

Threading tap—A multi-fluted tap for threading holes in all types of plastic materials has been announced by Hy-Pro Tool Co., New Bedford, Mass. Success of the tap is said to lie in a multi-fluted design which allows fast chip disposal; specific modifications in cutting angles; and a special surface treatment which assures proper lubrication.

High frequency bar sealing machine—Electronic Products Corp., 135 S. LaSalle St., Chicago, Ill., has announced a high frequency bar sealing machine which will seal thermoplastic film as thin as 1 mil. The equipment consists of a radio frequency generator, an air press built into the machine column, and a sheet metal cabinet on which the press is mounted. The unit is being made in three sizes—500, 1500, and 3000 watt output ratings. Controls are interlocked for a semi-automatic cycle.

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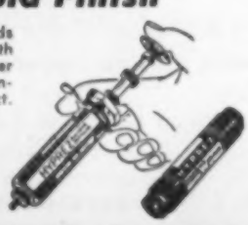

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ENGIS EQUIPMENT COMPANY
431 So. Dearborn St., Chicago 5, Ill., U.S.A.

Six-piece molded polystyrene salad set consists of one large bowl, four small individual bowls, and a server

Salad Set

COMBINING an attractive package with a colorful product is simply good merchandising, an axiom which was followed in the case of the six piece salad set, pictured above, which is molded either of Lustron or Styron.

Polystyrene was chosen for the molding material because of its dimensional stability, good molding properties, and beautiful finished luster. The plastic set consists of one 11-in. salad bowl, four 5-in. individual salad bowls, and a scissor type combination spoon and fork salad server. At the present time the Ballerina Salad Set, as it is called, is being molded in the following four colors—red, yellow, green, and blue.

In merchandising the salad set, one of the usual rules of packaging was reversed. Alladin Plastics, Inc., Los Angeles, Calif., the manufacturer of the salad set, decided to use the smallest possible box for holding the set, instead of a package that would spread the items out to look like greater value. Thus, by minimizing the size of the three-color folding box, they were able to pack 12 sets to a case, yet maintain good retail display by virtue of the brilliancy of the printed package plus the attractiveness of the plastic products.

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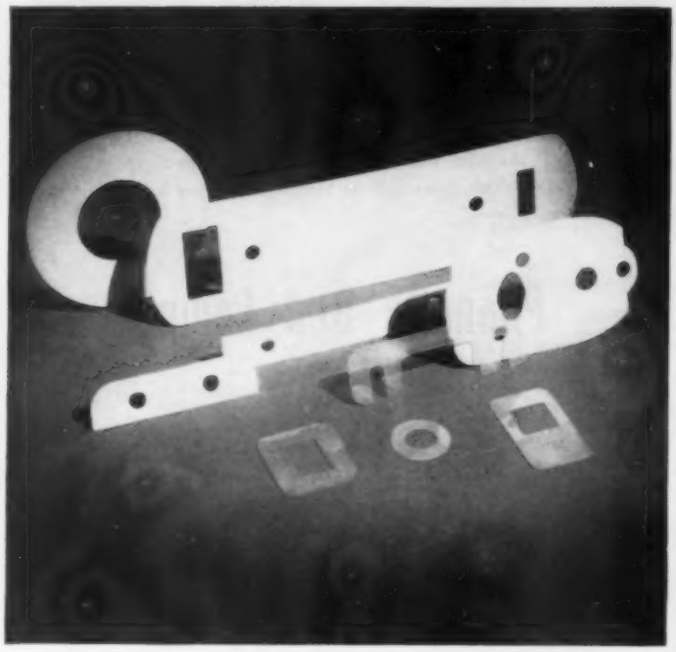

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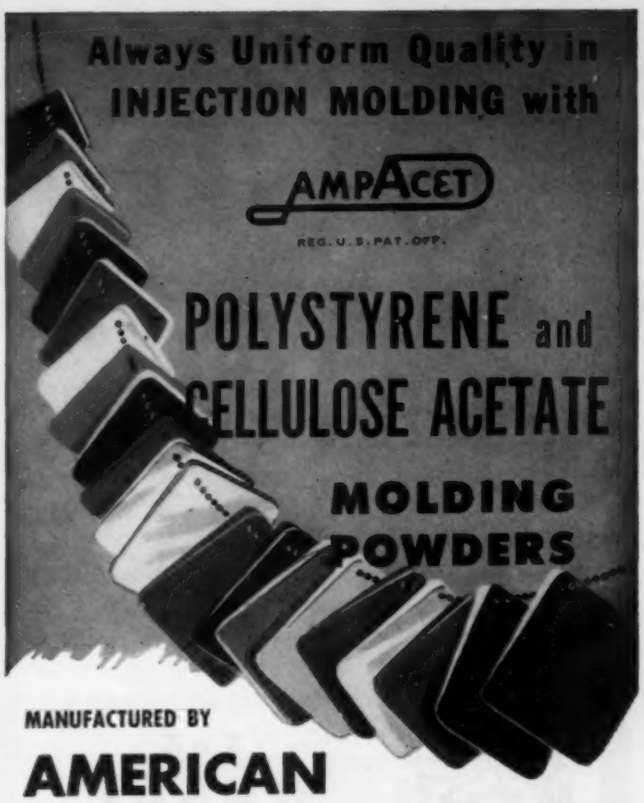

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ROCKFORD Anderson BROS. MFG. CO. ILLINOIS

ANDERSON BROS. MFG. CO., ROCKFORD, ILLINOIS

A two-piece phenolic housing is used in this spotlight type bed lamp which can easily be clamped to a bed head

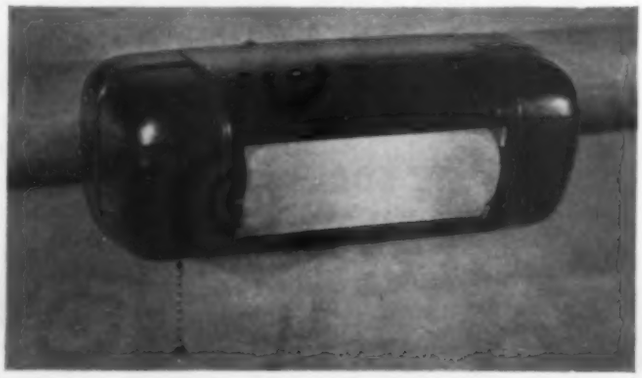
Phenolic Bed Lamps

FUNCTIONAL, sturdy, non-corrosive, easy-to-clean — these qualifications have been met in two different types of bed lamps through the use of phenolic housings. Both lamps are manufactured by Eagle Electric Mfg. Co., Long Island City, N. Y.

Resinox phenolic in a walnut finish is used to mold the two-part housing of the spotlight lamp above and the one-piece shade of the lamp below. The spotlight lamp has a magnifying lens and an especially designed adjusting joint which permits light to be concentrated on any desired spot. The clamp, which attaches the light to the bed, is lined with felt to prevent marring of surfaces and has a jaw spread of 2½ inches.

A diffused reading light is provided by the lamp below which also makes use of white Plastacele cellulose acetate. This material is used in sheet form as a light panel. To facilitate cleaning, the phenolic shade may be slipped off without necessitating removal of the entire lamp.

Diffused light is provided through the use of a cellulose acetate panel. Removable shade is molded of phenolic



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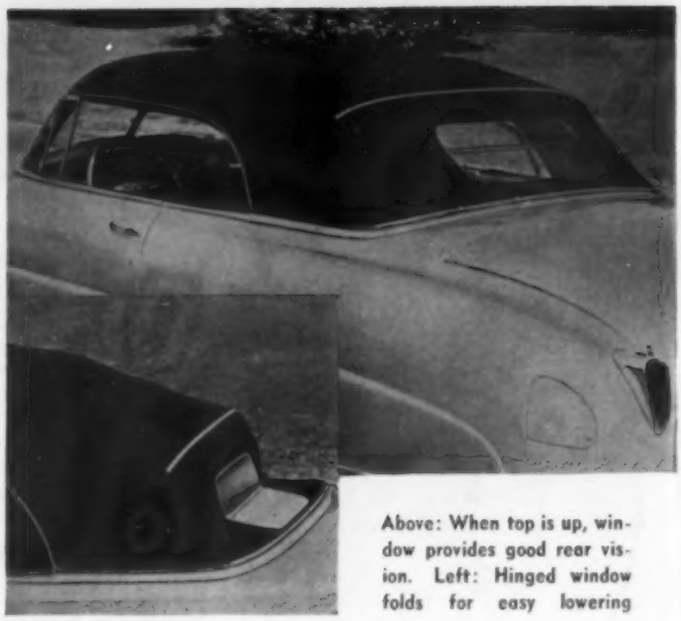

Above: When top is up, window provides good rear vision. Left: Hinged window folds for easy lowering

Folding Window for Convertibles

BY ingeniously employing the vinyl butyral interlayer of safety glass as a self-hinge dividing the glass area horizontally, Hudson Motor Car Co., Detroit, Mich., has been able to incorporate a full-sized rear window in its new convertible brougham model. The Foldaway window, as it is called, gives 100% more rear vision with the top up than is usually had with convertible windows, yet folds when the top is lowered.

Hinge 0.040 in. thick

Conceived by Hudson engineers, the folding window is made by Pittsburgh Plate Glass Co., Pittsburgh, Pa. In producing the Foldaway window, two thicknesses of 0.020 vinyl butyral material are blanked out, sufficiently larger than the glass area to provide a border on all sides. Before the curing operation, a strip of cloth is sandwiched between the projecting layers of vinyl material to provide a tough edge which is later sewn to the cloth back section of the top.

In placing the four pieces of the plate glass in the layup prior to curing, a gap of slightly less than 1 in. is left open, so that the exposed vinyl may serve as a hinge.

The two layers of plastic provide a total thickness of 0.040 in., which is more than twice that employed in a conventional vinyl butyral interlayer, giving plenty of strength to fulfill the necessary function of a hinge.

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GLADITE revolutionizes the cold-molding plastic field. Requiring NO PRE-HEATING, NO PRE-FORMING, NO AFTER BAKING, NO TUMBLING, your product comes out of the pre-form press *finished* . . . needs no buffing, grinding, or polishing. You save man hours and cut production costs.

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GLADITE comes in a variety of colors. Can be provided with special dielectric properties for electrical insulating uses; formulated to WITHSTAND TEMPERATURES UP TO 700° F. Finished products are resistant to oil, alcohol and other organic solvents.

GLADITE overcomes almost all previous disadvantages of cold-molding plastic powders. Physical properties can be varied by formula to adapt it to many uses.

Write for free sample canister and try it on your presses. Our engineers are at your service.

Property	GLADITE
Flow	Free Flowing
Bulk Factor	2 to 1
Colors	Black to light pastel
Uniformity of Colors	Good
Dielectric Strength	Good
ARC RESISTANCE	480 seconds (no failure)
Molding Pressure	12 to 15 ton/in.²
Rockwell Hardness	H72
Solubility:	
Alcohol	Slightly to insoluble
ORGANIC SOLVENTS	Insoluble
WATER	0—2% 48 Hr. Test
Oil	Insoluble
Compression Strength	10,000# / in.²
Impact Strength	1.93 ave. IZOD
Dimensional Stability	Excellent

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SALES representatives of Bausch and Lomb Optical Co. may have to adopt drastic new methods of product punishment in order to demonstrate adequately the properties of the company's new Balplex eyeglass cases. Molded of Bakelite polyethylene by Westplex Corp., Rochester, N. Y., the new cases cannot be scuffed, cracked, or peeled, may be jumped on, dipped into boiling water, immersed in grease and all common chemicals and solvents, exposed to sub-zero and tropical temperatures, and left indefinitely in the sunlight with no deterioration whatever, either in product appearance, usefulness, size, or shape.

The aim of the optical company's design engineers was threefold: a) to produce a more economical case than those which had formerly been made in leather or imitation leather; b) to produce a better case functionally; and c) to produce the cases in a wide range of permanent colors that would also be attractive in appearance.

Molded in one piece

The new case is being molded in a single piece. It has no wooden parts to crack, break, chip, or become dislocated, no metal parts to rust, no threads or stitched seams to tear or break. Adding to the natural toughness of the plastic material is a stiffener section formed of vertical ribs molded as an integral part of the case. The interior has the natural satin-soft surface of the material; the exterior has been given a morocco-type grain finish with raised ribs on the large flap which also provides ample space for imprinting the customer's name.

The new case is available in nine colors including white.

Molded of polyethylene, these spectacle cases, which come in nine colors, are resistant to all sorts of punishment

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Lustrex: Reg. U. S. Pat. Off.

Lustrex special formula modifications (including a number of new ones) to suit particular applications will be designated by suitable suffixes as shown in the table at right. This will make for convenience in ordering, but no attempt will be made to carry these symbols beyond the trade.

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LUSTREX LX	Heat-resistant polystyrene, formerly Lustrex.
Special formulations for specific uses	
LUSTREX L-P1L	General purpose polystyrene.
LUSTREX L-P1	Transparent colors and crystal with superior clarity.
LUSTREX L-P1X	Improved moldability over L-P1; available in crystal only.
LUSTREX L-P1A	Improved moldability in transparent colors.
LUSTREX L-P1B	Translucent and opaque colors with exceptionally good moldability.
LUSTREX LX-P1L	All the excellent properties of L-P1L plus highest heat resistance of any commercially available polystyrene.

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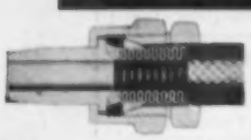

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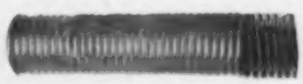

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Cervical Applicators

molded of nylon have been developed in Canada for specialized radium treatments

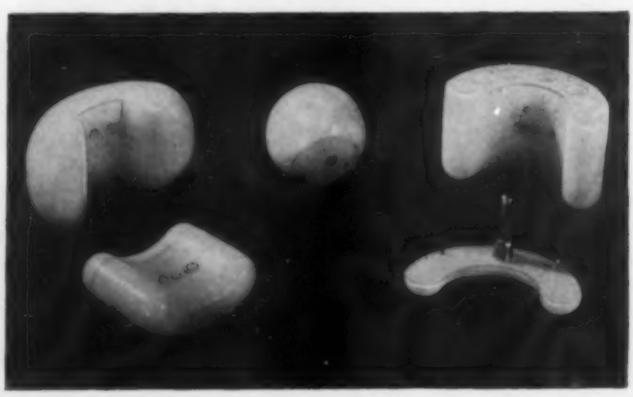
NYLON'S strength, ability to be sterilized by boiling, and its molecular composition of carbon, hydrogen, and nitrogen—all elements having the same atomic numbers as human tissue—has led to its use in cervical radium applicators for treating cancer of the cervix. All metal parts, except locking and dowel pins, are eliminated. These applicators are also said to be easier to hold in proper position and to lessen the danger to personnel in handling.

Receptacles for radium

Two types are now being molded by Percy Hermant Ltd., Toronto, Canada: cervical radium applicators in small, medium, and large sizes, and spherical radium applicators in one size only. The cervical type consists of a curved one piece unit with receptacles in which the radium is loaded, joined together by a bridge or spacer. The ends conform to the shape of the field of intensity around any radium source. A pinned cover permits loading entirely by instruments. Holes are molded in the bridge for insertion of the "fork" which is used to place and hold the applicator in position against the cervix.

When the Hermant company first designed these units, drilling of the receptacles for radium was considered. Since the wall sections varied in thickness from ¼ in. to sections little thicker than a piece of paper, it was feared that drilling might tend to break through the piece or run out of line. In the final design these holes were molded in. Finishing is done by hand and holes for pins are drilled and tapped when necessary. Photo below shows type of pin used.

Cervical and spherical applicators each consists of a pinned nylon cover on a one-piece nylon body for holding radium



Vinyls

(*Continued from page* 65)

An important switch to vinyl from pyroxylin for auto upholstery has been in beading and trim because vinyl does not flake or scuff so easily.

Pyroxylin is still running strong in lightweight coatings for such things as book bindings, low cost boxes, airplane type bags, childrens' toy pistol holsters, memo books, advertising novelties, etc., because of glueing and embossing advantages. A great deal of know-how and skill is required to heat emboss vinyl, and not all processors are prepared to handle it. They are all familiar with pyroxylin.

Growth in the fabric coating and related processing industries is indicated by the addition of some 40 new and important companies to the 38 that existed before the war.

Vinyl treatment or coating of paper dropped off in 1948 because of the resurging of oil-cloth for which vinyl coated paper had been pinch hitting. However, the latter is on the market to stay. Consumers still like it as shelf paper, etc., but competition is at work. This category is expected to increase again in 1949 when vinyl coated paper window drapes make their impact on the market.

The molding and extrusion division of the industry is still dominated by wire and cable insulation which probably accounts for half of the resin listed in the category in Table III, page 63. Extrusions such as belts and garden hose may account for 10,000,000 or 12,000,000 lb.; some 15% of all garden hose produced in 1948 is estimated to be vinyl. The balance is for phonograph records, rigid vinyl, and miscellaneous. The molding part of the industry has not even started — operators and producers have been too busy with other things. Because of the complexities involved in estimating this category, the figure of 40,000,000 lb. for 1948 may be several million pounds high, but the correct sum is almost certainly somewhere between 34,000,000 and 40,000,000 pounds.

The last category, "All other," is arrived at by a process of elimination. It includes all resin that can't be classified in the other divisions. It is also tangled up because one company, for example, reports resin used in floor covering in "Sheeting" and another reports the same type of resin as miscellaneous. Vinyl floor covering has made nowhere near the progress expected, but it is still a most promising field. One floor covering company with a 1/32 in. vinyl coating over felt backing has made remarkable progress in the last few months at a price competitive with linoleum.

Other vinyl uses in this "All other" section include beer-can linings, strip coat materials for protection of metal, surface coatings, and a whole raft of miscellaneous uses that may be small now but will almost certainly increase in the future.

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UNIVERSAL 2oz. HYDRAULIC

Plastics Injection Press for Production Runs

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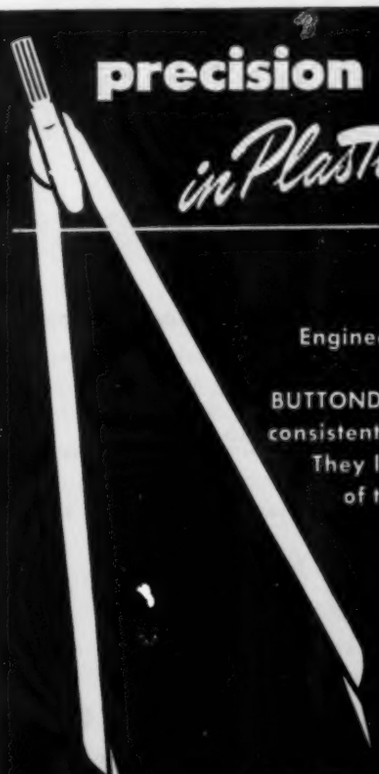

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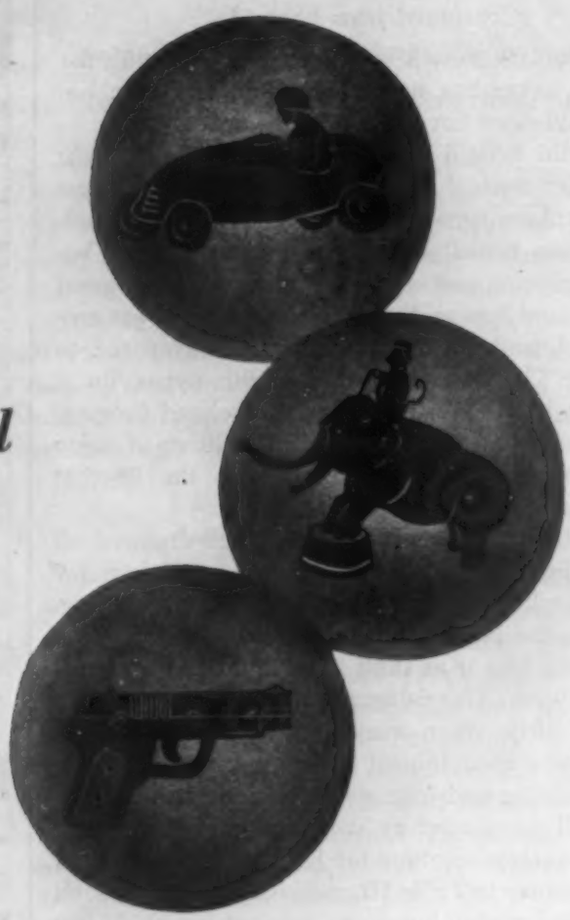

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PLASTIC MATERIALS

GERING PRODUCTS, Inc.

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Polystyrene

(*Continued from page* 66)

Emulsions containing polystyrene or styrene monomer are also gaining ground—perhaps more so than molding powder; but current poundage of consumption is small. They are just beginning and not much knowledge of their usefulness has been made public. One being used as an extender to make casein go farther for coating paper is perhaps the best known. It may help make more rapid printing on paper possible. Another similar use is to extend linseed oil in oilcloth manufacturing. One of these emulsions also looks good as a water-resistant coating for cement blocks. It can be pigmentized, spread like paint, and used outdoors.

Still other uses include a plasticized polystyrene in textiles for shrink prevention and a monomer used for sizing in place of gelatine for acetate and viscose warp slashing which helps to smooth the threads for weaving.

Styrene monomers and copolymers constitute a new field for plastics not yet developed far enough for lengthy discussion here, but many phases were covered in this magazine last June and July. It is a field in which products will be competitive to many plastics now on the market and is deserving of close attention by all processors. The styrene chemical family is only now beginning to make its presence known to the industrial world because nearly all the styrene that was available has been used for GR-S rubber and polystyrene, but its possibilities are endless. Copolymers with butadiene, vinyl, acrylonitrile, and many other chemicals are possible to give a variety of products with all kinds of properties. Then, too, there is another class of material involved in which polystyrene is simply mixed with or compounded with some other material much as vinyl is mixed with a plasticizer. Nearly all these materials are notable for toughness; most of them have higher heat resistance.

One of the oldest is Monsanto's Cerex, a high-heat resistant material, supposedly a styrene copolymer, announced early in the war but quiescent for some time. It is now about ready for circulation.

Plexene, announced right after the war by Rohm & Haas, has been held up by unavailability of raw materials but is now in good supply. Priced at 54¢ a lb., it is competitive with the tougher cellulosics and is comparatively easy to mold but is claimed to have higher heat resistance and less cold flow. Having low water absorption and good electrical properties, it has been used for pens, pencils, coil forms, oil gages, and radio parts.

Tuflite, by Goodyear, is a combination of Pliolite and rubber. Pliolite is one of the high styrene-butadiene copolymers similar to those now produced by most of the major rubber companies and several

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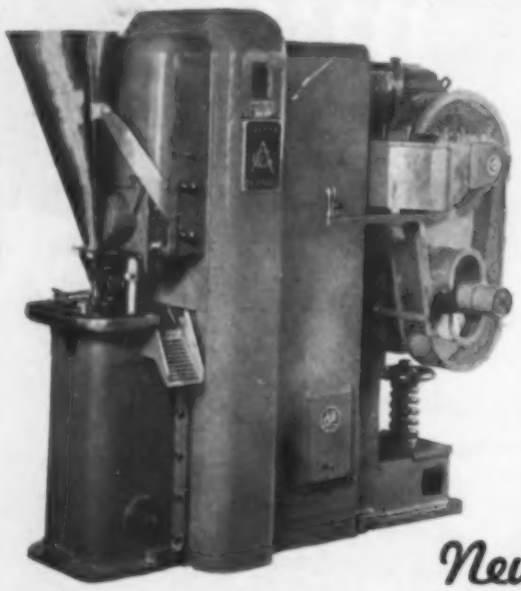

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other raw materials companies. Tuflite is tough, has good high-temperature resistance, and is currently being used for golf club heads, bowling pins, etc. The high styrene-butadiene compounds, like Pliolite, are already finding wide use in shoe soles, floor coverings, paint, etc.

Versalite is a United States Rubber product which, according to the patent, consists of many combinations employing primarily styrene, butadiene, and acrylonitrile. It is being manufactured in sheet form for deep drawing where it has been found applicable for tote boxes, insulated shipping containers, and has been tried for auto fenders.

Cellulosics

(*Continued from page* 69)

big advantage of acetate is its ability to permit gas permeation through the film and thus delay decay of the vegetable or fruit.

Comparative costs of the different film and papers used in packaging are given in Table V on page 68.

Production of acetate film is now being carried out by a method which perhaps will help cut costs by a considerable amount. An extrusion process in which the film is either slit or stretched after emergence from the extruder looks promising as a speed-up measure. Present production ranges from 0.003 to 0.060 inch. Using 0.020 gage as an example, the price of polished extruded sheet would be $1.00 a lb. in comparison to block polished sheet at $1.50 or cast at $1.31.

Casting over a wheel or on a belt has been the generally accepted production method for thin gage acetate. It can be made ½ mil or 0.00055 in. thick. Film as thin as 0.00077 in. has been reported, but the standard thickness is 0.0008 inches.

The block-solvent production method where the material is cast in a block and then sliced off or skived—a method now used for film and sheeting from 0.003 to 0.060 in.—is in danger of losing some of its market to extrusion.

Laminates: Another outlet for acetate is just beginning to make headway. It is fabric impregnated with cellulosic molding material and compression molded in extremely short cycles with a sort of metal-stamping technique. A cab company and an auto manufacturer are using it for kick plates, side panels, and head linings, and obtain an unusual effect by matching the fabric used for the upholstery. Radio cabinets and luggage have been covered with it. Rigid draperies for store displays and theaters, side pieces for furniture, and ladies' handbags to match their other apparel are all possibilities.

Ethyl cellulose: There has been a mystery about the ethyl cellulose consumption figures in 1948, with some doubt expressed as to the accuracy of the

government figures which total over 8,000,000 lb. for the year. This does not include the sizeable amount that has been going into phonograph records along with Vinsol to make a low cost record comparable with shellac. At least 20% of all low cost records were claimed to be in this material in 1947—no figure available for 1948. Neither does the above figure include the ethyl cellulose for lacquers and strippable coatings. Chrysler has been using the latter on its production line but requires only a small amount since the material can be reused. Some observers believe that the total above includes some distress material left over after the war, but even that figure was reportedly less than 1,000,000 pounds.

Supposedly the 8,000,000 lb. represents molding and extrusion compound only with about 2% for sheeting and other small uses. Extrusion is currently running ahead of molding compound for such products as breaker strips in refrigerators, pens and pencils, tool handles, flashlight cases, vacuum cleaner parts, etc.

Polyethylene

(*Continued from page 70*)

their excellence. The electrical resistance is so great that polyethylene cannot be electronically heat sealed; its solvent resistance makes it difficult to adhere to other materials or print on. It has very low moisture absorption and remains flexible at low temperature. As a molding material, it is tough and pliable. Of course, like any other plastic, it has certain disadvantages, such as low abrasion resistance, a waxy feel, a frosty instead of clear transparency (except when cast), and certain other sometimes undesirable qualities; but there are plenty of applications where its many superior properties make it a most logical selection. A project now underway to manufacture chlorinated polyethylene may improve its flame resistance and, assertedly, its feel or hand.

First and still most important outlet for polyethylene is in the electrical insulation field. Somewhere near 2,500,000 lb. a month may soon be used for that purpose if present applications continue to expand. Best known is the $\frac{3}{8}$-in. diameter disk used as coaxial cable spacers—there are as many as 506,000 disks per mile in a typical cable.

Another growing use is for telephone line wires. These are copper wire covered with cotton braid, then encased in aluminum, over which polyethylene is extruded. The aluminum and plastic have replaced lead and saved several million dollars for telephone companies.

Another application that could exceed those mentioned is the use of polyethylene to encase overhead power lines. Because of good weathering properties,

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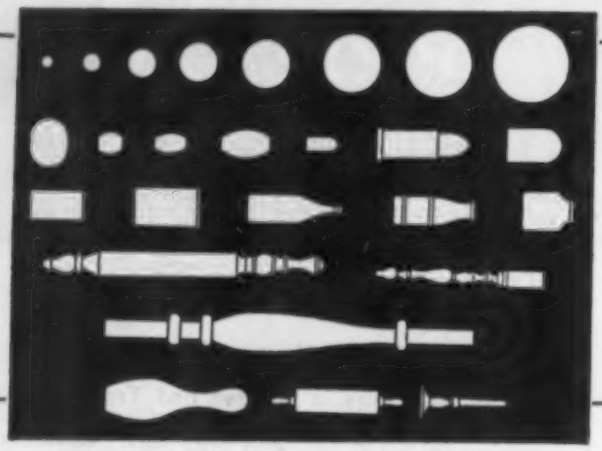

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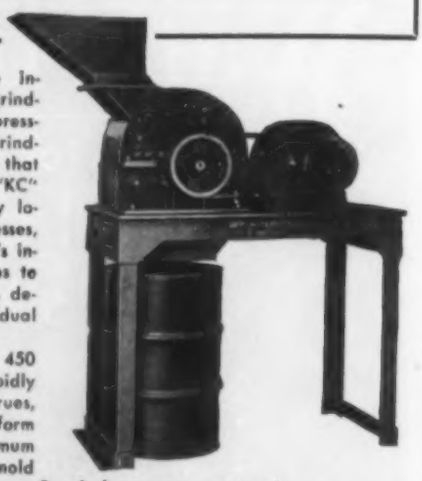

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the plastic is particularly desirable, but the application is still undergoing tests and has not yet been definitely accepted by the electric power companies.

Further improvements in formulations, intended primarily for wire coating but that will stretch out into other uses, are under way. One is a low molecular weight compound which, when added to paraffin or other waxes, upgrades the latter. Such compositions, when used as surface lubricants for plastic, rubber, or cotton-braid jacketed wire, facilitate pulling through ducts. They also give higher blocking temperatures, reduced rub-off, and increased strength of heat-sealed bonds. Waxes fortified with this composition show increased tensile strength. The lower molecular weight, approximately 12,000 in comparison to 18,000 to 20,000 for standard grade polyethylene, improves viscosity or flow and makes it possible to use the compound as a hot melt sealant and as a potting compound for coils and relays.

Among many other electrical applications, a growing one is the use of molded polyethylene antenna fittings on airplanes in order to obtain fair-weather radio reception even in the foulest weather. The new antenna systems control up to 90% of static from such sources as thunder clouds, rain, dust, and snow. Another electrical use of polyethylene is in a new watt hour meter where polyethylene is molded around the coil.

As a molding material, polyethylene's future seem assured. It molds comparatively easily after experience is acquired, but large pieces cool slowly and cannot be removed from the mold too rapidly. Color in finished molded parts is not as lustrous or brilliant as in other thermoplastics, but improvements have been made and will continue.

The best known molded pieces today are Tupperware nested bowls, tumblers, and other dishes, and refrigerator ice cube trays which have taken the country by storm, the former because of their all around utility, flexibility, and durability; the latter because of their low temperature flexibility and the ease with which they permit release of ice cubes. There are scores of small molded products now in production and many more to follow, with bottle closures looming as a major product for polyethylene. Their flexibility, chemical resistance, and lack of the necessity for using cap liners makes them desirable for the purpose. However, price is presently higher than other closure materials. With the closure industry employing over 20,000,000 lb. of plastics annually, it's a nice target to shoot at.

Polyethylene blown bottles have not yet made the progress expected, perhaps due to cost and scarcity of material. Nevertheless, it seems a field with extravagant possibilities, even if price competition with glass is never met. Unbreakable flexible bottles and vials with chemical resistance to even

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This trunk lid ornament was pretested in our quality control department to determine that it would take the punishment of sub-zero and hundred-plus temperatures; rain, snow, ice, and scorching sun which the part would be subjected to in service.

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sulfuric acid offers a great market even though polyethylene takes only a small portion of the total bottle field. It seems a natural for acids, cosmetics, and medicines.

Potentially big as all these things are, the largest potentiality of all in some estimators' opinions is polyethylene film. Extruded in thicknesses of from 1 mil up and as wide as 54 or 72 in., the 2 mil film can be sold at 75¢ a lb., or 1000 sq. in. for about 5¢, in comparison to 1000 sq. in. of moisture-proof cellophane in 1.4 mil thickness at from 4.8 to 5.6¢ per M sq. inches. In cast film, the polyethylene cost would be about $1.00 a pound.

It is the 165,000,000 lb. cellophane field that polyethylene film hopes to break into with a thin packaging film for many types of merchandise wrappers. It is expected to take over a portion of the fresh food packaging film, especially if it can be successfully perforated to permit breathing, and is almost certain to sell thousands of pounds for frozen food packages when a few technical difficulties are overcome and price comes down. Heat sealing is a little more complicated than with most other films, but flame heat can be used satisfactorily when the jaws of the sealer are coated with silicone rubber or Teflon, or by using a cellophane slip sheet. Two companies are reported to have successful modifications of electronic sealers for polyethylene. One company has a sealer that clamps the film between two stainless steel belts on which it is carried through a heating zone and then a cooling zone. After cooling, the film is released without sticking.

Printing remains a problem for all but one or two printers who have concentrated on it. Ordinary inks won't stick to polyethylene because they are carried in solvents that won't touch the plastic; but oven heat after printing has been used with success in some cases.

Even if polyethylene film or sheeting is never employed in large portions of the big volume packaging field, its use for specialty markets is assured. Perhaps the most spectacular so far are Shellies, or infants' disposable and sanitary milk bottles. Then there are humus bags which won't rot; wraps for frozen poultry; bags for shipping ball bearings in oil; liners for metal or fiber containers for chemicals; packages for white wall tires, tube patches, and other rubber products because they won't stick to it; and blanket bags.

In other than packaging fields, polyethylene film has many possibilities. There is a difference of opinion about its use in garments because it tears and gives a noisy, metallic sound when rustled. But for table cloth covers, perhaps curtains and certain other fabric-like uses, it is a possibility.

For medical purposes, polyethylene is constantly finding new employment. It is said to be the most satisfactory substitute for human cartilage and bone

in plastic surgery, has been used to reconstruct portions of the skull, bile duct, and arterial parts, and as implants for chins, noses, and ears. Doctors say it has advantages over use of cartilage and bone because it will not dissolve or warp, rapidly becomes adherent, resists displacement, and produces less post-operative reaction than cartilage.

Extruded tubing and pipe with molded valves and joints is also a growing business for polyethylene. Ease of processing and chemical resistance make such products ideal for chemical, paper, and textile plants where corrosion is a problem.

Another intriguing possibility is flame spraying for lining vats. The application has not yet been satisfactorily worked out; perhaps an improved system of applying the material is needed.

Principle use of extruded polyethylene filaments so far has been in woven seat covers for automobiles; several Pullman cars have also been fitted with chairs upholstered in this material. Two years ago there was a problem of filament shrinkage that handicapped usage, but today developers claim that they can guarantee a shrinkage in the warp of less than 4% and less than 2% in the fill at 155° F. That is less shrinkage than cotton.

Polyethylene brush bristles have also been extruded but are presently impractical. For one thing, it is almost impossible to get dust out after it has been picked up by the static. Like most other polyethylene developments, this one is especially handicapped by shortage of material. The year 1949 may be the one in which it will receive a chance to prove itself.

Where Plastics Are Made

(*Continued from page 76*)

Springfield, Ore., plant which was built in 1946.

The Chemical Div. also announces expansion of its Durite production facilities. Output of both resins and molding compounds will be increased 200 to 300% during the first quarter of 1949. Also, a wider range of colors will be made available.

The location and products of the Borden Chemical Div.'s plants formerly operating under the Casein Company of America name are:

Bainbridge, N. Y.: Casein materials, urea formaldehyde, phenolic and resorcin resins, casting resins, polyvinyl-resin emulsion, and (in 1949) formaldehyde.

Union, Ill.: Casein glue and raw casein.

Kernersville, N. C.: Liquid urea formaldehyde resin.

Seattle, Wash.: Casein glues, liquid urea, phenol and resorcin resin, and polyvinyl resin emulsion.

Springfield, Ore.: Formaldehyde, liquid urea, and phenol resins. (*Please turn the page*)

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The Durite plant in Philadelphia, Pa., produces phenolic thermosetting molding compounds and industrial resins such as those used in brake linings, laminating, varnishes, etc.

Catalin Corp. of America has expanded its production facilities in Fords, N. J., but has never announced the extent of that expansion. The company has been a manufacturer of phenolic casting resins for a great many years and is now developing new types which will be light-fast and suitable for exterior use.

Celanese Corp. of America — Expansion of the Newark, N. J., plant where the company produces Lumarith film and transparent sheeting was hampered by a shortage of construction materials and by an explosion in the solvent recovery section which occurred on December 15, 1947. However, the plant is now well on the way towards completion, and in the first quarter of 1949 will have approximately 50% more capacity for film and sheeting than in the past.

The new plant at Belvidere, N. J., is now producing cellulose acetate and cellulose propionate molding materials. Propionate is still in pilot plant production but in fair-sized quantity, nevertheless. The company has not announced the extent of its expansion program in these materials.

Cellulose acetate flake, a large part of which is devoted to the company's yarn output, is produced at Cumberland, Md., and at Narrows, Va.

Tricresyl phosphate and other plasticizers are produced in the Newark, N. J., plant. Chemicals for plastics, such as acetic acid, acetaldehyde, acetone, formaldehyde, and various alcohols, are produced in Bishop, Texas.

The company's wood pulp producing plant to be constructed near Prince Rupert in British Columbia, Can., and which will eventually assure a steady flow of raw material for producing cellulose acetate, is not yet ready for operation but may be expected to start producing within the next year or two.

Sales of the Celanese Corp. of America have increased from $35,000,000 in 1939 to $181,000,000 in 1947. For the first nine months of 1948, sales aggregated $172,000,000, as against $129,000,000 for the corresponding period of 1947. The percent of plastics sales has never been announced. The company's personnel included 22,820 persons as of December 31, 1947.

The Dow Chemical Co. — All Dow plants producing resins and molding powders are located in Midland, Mich. The expansion program for polystyrene (marketed under the trade name Styron) was completed in 1947. Three new polystyrenes announced during 1948 give greater toughness, light stabilization, and heat resistance. (*To page* 148)

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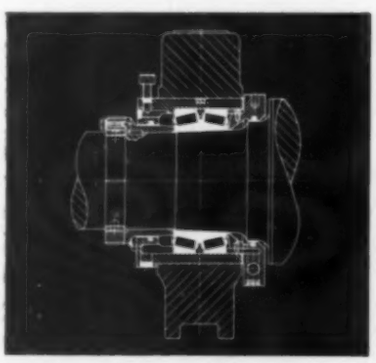
Mills are more rigid because Timken balanced proportion bearings make possible larger roll neck diameters, with 50% to 60% increased roll neck strength. Load ratings are higher, too — up to 40% higher than previous designs of tapered roller bearings, size for size.



The photograph shows a typical example of a modern Timken bearing equipped plastics mill. It was designed and built by Dominion Engineering Works, Montreal, Canada, and is installed at the plant of Canadian Resins and Chemicals Limited, Shawinigan Falls, Quebec. There is a standardized Timken bearing application ready for your new or existing mills. Consult the mill builder or our engineers. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address "Timrosco".

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No expansion plans for Ethocel (Dow's ethyl cellulose) have been announced. Saran (vinylidene chloride polymers) capacity has been increased several times since the end of the war, and further increases are contemplated in the future.

A new butadiene-styrene latex is being produced in Midland for use in paper finishing.

Dow Corning Corp., an associated company also in Midland, produces silicone materials. The Saran Yarns Co., another associate company, has been set up at Odenton, Md., for the production of fine filaments.

Phenol, great quantities of which are used in the plastics industry and of which Dow is one of the largest producers, is produced at the Midland plant.

Styrene monomer plants are located in Midland, Velasco, Texas, and Sarnia, Ont., Can. There is also a plant operated for the government in California.

Dow sales for the fiscal year ended May 31, 1948, were $171,000,000 in comparison with $130,000,000 for the previous fiscal year. A recent press report stated that sales would probably top $200,000,000 for the year ending May 31, 1949. The company reports that 54% of its total sales were in industrial chemicals and 6% in magnesium.

E. I. du Pont de Nemours & Co., Inc.—A portion of this company's projected new capacity for manufacturing polythene started to come into production in the last quarter of 1948 at its Sabine River Works in Texas.

All units of Du Pont's new and modern plastics plant near Parkersburg, W. Va., are now operating. This plant makes molding powders of Lucite acrylic resin, nylon, and compounded polythene, as well as nylon monofilaments.

The new facilities at Parkersburg, representing the company's greatest single expansion in plastics since it entered the industry in 1915, more than double previous capacity in Lucite molding powders and increase by several times the original capacity for compounded polythene. In the case of nylon, the company is now in a position to make about three times more polymer for molding powder and monofilament.

The Parkersburg operation is in addition to production at the Arlington, N. J., plant where Du Pont manufactures Lucite sheeting, polyvinyl acetal resin for automotive safety glass, Teflon tetrafluoroethylene resin, and sheets, rods, and tubes of Pyralin cellulose nitrate and Plastacele cellulose acetate plastics.

The company's new capacity for making crystal urea at the Belle, W. Va., Works started to come into production in the latter part of the year.

The construction of a multi-million dollar plant for the production of its new synthetic textile fiber, Orlon, at a site near Camden, S. C., was also announced by the company last October. Orlon is pre-

sumably classified as an acrylonitrile material.

The corporation as a whole reports that its added capacity was principally for production of nylon products and materials entering into their manufacture, acrylic resins, acetate rayon yarn, cellophane, synthetic methanol, ethylene glycol for antifreeze, polythene, pigments, sulfuric acid, nitrocellulose for lacquers, photographic film and coated fabrics, and synthetic detergents for textile and other purposes.

Production of all Du Pont products in the first nine months of 1948 reached the highest level for a comparable peace-time period in the company's history. Sales for the first nine months increased to $709,000,000 from the $574,000,000 volume for the same period in 1947.

The company has never specified how much of its sales volume should be credited to plastics. Total sales for 1947 were $783,000,000 compared to $709,000,000 in 1946. New products introduced or substantially developed in the past 20 years account for some 58% of the company's sales volume in 1947 and gave employment to approximately 33,700 workers. Total number of workers at the close of 1947 was 75,945.

Durez Plastics & Chemicals, Inc.—All expansion plans have been completed so that the company now has production facilities that double its pre-war output. All types of phenolic materials are produced at North Tonawanda, N. Y., where the company has completed a plant for the production of a portion of its requirements for formaldehyde. The company has also completed construction of a wood-flour plant to supply part of its needs and has increased production of its phenol plant built in 1940.

General Electric Co., Chemical Dept. announced early in 1948 that it would market a complete line of phenolic molding powders and varnishes, which would be produced, together with synthetic phenol, at the Pittsfield, Mass., plant. Phenolic liquid resins and varnishes are also produced at the company's new plant in Coshocton, Ohio. The company has manufactured these materials for its own use for years but never before made them available to other molding plants.

A new multi-million dollar chemical plant for the manufacture of silicone materials began operation at Waterford, N. Y. All of the company's silicone materials are produced there. Silicone rubber gum is compounded and molded at Pittsfield.

Glyptal alkyd resins are produced at Schenectady, N. Y., and at a new G. E. plant in Anaheim, Calif.

B. F. Goodrich Chemical Co. announced during the year a $3,000,000 expansion of its manufacturing facilities with the construction of a general chemicals plant at Avon Lake, Ohio. At this plant the

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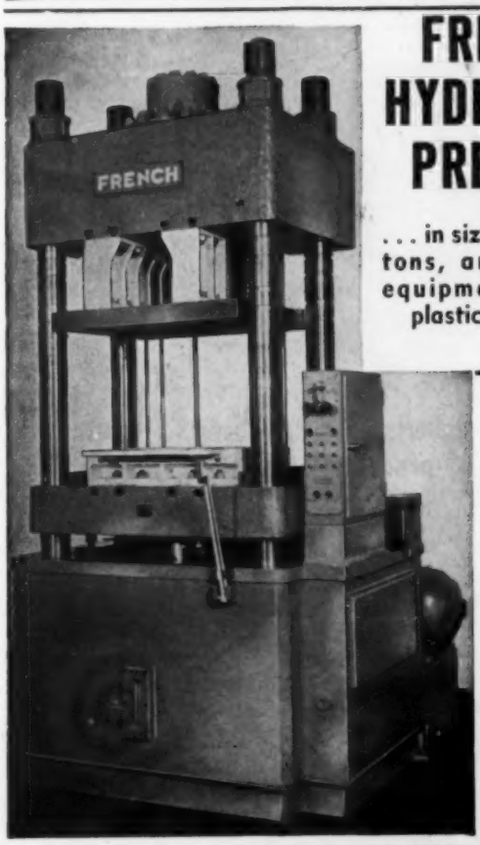

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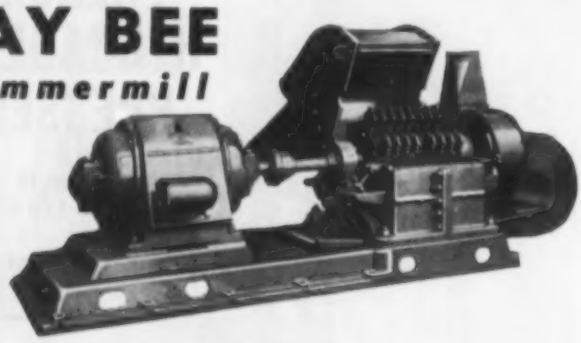

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company will manufacture, in addition to a varied line of chemicals, plasticizers for vinyl and other synthetic resins. New operations at its Louisville Geon plant include the manufacture of Hycar latices and Geon polyblend latices, the latter being a recently announced material. It has also been announced that Good-rite Resin 50, the company's high styrene copolymer resin, will be manufactured at the Louisville Geon plant.

Goodrich Chemical's manufacturing plants are located at Louisville, Ky., Geon polyvinyl materials including polyblend, Hycar latices, and Good-rite Resin 50; Niagara Falls, N. Y., Geon polyvinyl materials; Akron, Ohio, Hycar American rubbers; Avon Lake, Ohio, general chemicals and plasticizers.

The Goodyear Tire & Rubber Co. created a Chemicals Div. after the war to handle its synthetic resins; constructed a new chemical products development laboratory in Akron, Ohio; built and placed in operation a vinyl resin production plant at Niagara Falls, N. Y.; installed production equipment for the use of vinyl resins in film and flooring applications at Akron; and is now completing a $5,000,000 expansion program for stepping up its output of Pliofilm in Akron.

The company now markets Pliovic, its vinyl copolymer resin; Tuflite, a high styrene-butadiene resin combined with rubber; and Pliolite, a high styrene-butadiene compound which in its numerous variations is used in paper coating, paint, lacquer, reinforcing latices, shoe soles, floor coverings, etc.

Hercules Powder Co., Inc., has more than doubled its cellulose acetate flake production facilities since 1945 by the completion in 1948 of a cellulose acetate flake plant at Parlin, N. J. Ethyl cellulose flake production capacity was increased 20% over wartime production at the plant in Hopewell, Va. The company manufactures nitro cellulose and Clorafin (chlorinated paraffin), a material used as low-cost plasticizer for vinyls, in Parlin, N. J. Vinsol resin, a material derived from rosin and used with plastics in a great many applications, is manufactured at Brunswick, Ga., and Hattiesburg, Miss.

Hercules has expanded from an organization with seven plants (all explosives) in 1913 to one now operating 23 plants, eight of which manufacture explosives. Investments in plants and properties in 1913 amounted to $6,000,000; on December 31, 1947, the investment was $80,000,000, and the company has increased the number of its employees from about 1000 to 10,000. Construction expenditures since the war have amounted to over $15,000,000 in fields supplying the plastics resin, protective coatings, and related industries. Net sales and operating revenues in 1947 were $131,000,000 compared with $101,000,000 in 1946 and $27,000,000 just 20 years ago in 1928. The percentage of this business going to plastics has not been identified. (*To page* 152)

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Net sales for the first nine months' period in 1948 were $97,500,000, compared with $99,000,000 in the corresponding 1947 period.

Interlake Chemical Corp., jointly owned by National Steel Corp. and Interlake Iron Corp., completed a 50% production expansion in April of 1948 in the phenolic resin plant at Forest Park, Ill. Products manufactured at that location are phenolic plywood adhesives, laminating varnishes, mineral wool binders, and a wide range of specialty products. Furan resins were recently introduced and are now being manufactured at that plant.

The company's Waltham, Mass., plant for production of phenolic molding compound suffered an accident which resulted in the destruction of a major portion of the plant in 1948. The company has announced that it does not contemplate immediate rebuilding.

M. W. Kellogg Co., engineers and fabricators, of Jersey City, N. J., and New York, N. Y., entered plastics in 1948 by announcing commercial production in limited quantities of Kel-F, a new high temperature plastic. The new plastic is a polymer of trifluorochloroethylene. It is related to the fluorocarbons but differs from them in that some of the fluorine is replaced by chlorine.

Koppers Co., Inc. completed additional polystyrene and ethylene producing facilities at Kobuta, Pa., late in 1948. It now has capacity for the production and coloring of approximately 20,000,000 lb. of polystyrene a year at this plant.

At the former Chemaco plant in Berkeley Heights, N. J., polystyrene, ethyl cellulose, and cellulose acetate are compounded and colored. The capacity of this plant is 6,000,000 lb. a year.

The Chemical Div. of Koppers contemplates production of additional alkylated phenols at its plant in Oil City, Pa., during 1949. At this division's Kearny, N. J., plant, pure hydrocyanic acid is being produced from coke oven gas, the first operation of its kind in the country. This plant went into production in the fall of 1948 and is expected to greatly increase production in 1949.

Resorcinol and resorcinol adhesives are manufactured at Koppers' Petrolia, Pa., plant.

The Glenn L. Martin Co., Chemicals Div. began production of vinyl resins in its new plant in Painesville, Ohio, in March, 1948. According to company announcement, annual capacity was expected to reach 25,000,000 lb. by late 1948. Production here will include a series of vinyl resins, plasticizers, and stabilizers, all known as Marvinol.

Monsanto Chemical Co.—The $17,000,000 expansion program for the Plastics Div. of Monsanto,

which started almost immediately after V-J Day, has been substantially completed.

In March, 1947, the company began construction of facilities for the production of Ultron vinyl chloride resin and compounds. This plant is now in operation, and Ultron resin and compounds are currently being offered to the trade. Film and heavy sheeting will be available early in 1949.

The thermosetting materials group has been greatly strengthened by the completion of plants to supply basic raw materials. Among these are a wood-flour plant which assures a continued supply of filler material, and a formaldehyde plant at Springfield, Mass., which has been in operation for about three months. With the production of wood-flour and formaldehyde in Springfield, phenol in St. Louis, Mo., and melamine at Everett, Mass., Monsanto is now in a more secure position on basic raw materials than ever before.

There are a number of additions to the Resimene (melamine) group, particularly in the field of surface coating resins. Resimene 814-S, a spray-dried material for the production of decorative laminates, is also in full-scale production.

Reconstruction of the Texas City styrene monomer plant has been completed, and monomer is being supplied to Springfield from Texas City.

In the thermoplastic materials category, Lustrex, heat-resistant unmodified polystyrene, and Cerex 250 are now being produced in commercial quantities at the Springfield plant.

Effective October 1, 1948, the Eastern operations of Monsanto's Western Div. were absorbed into the Plastics Div., giving a complete line of resinous and protein adhesives for the plywood and wood working industries. Manufacture of these products will be carried on in the future at Springfield and at Decatur, Ill. Expansion into fields other than plywood adhesives is planned for 1949.

Among other products used by the plastics industry, Monsanto produces polyvinyl butyral for safety glass, sheeting, and fabric coating, at Springfield. Resloom, a melamine for use in shrinkage control of textiles, is produced at Everett. Plasticizers for plastics are manufactured in St. Louis, Mo. Maleic anhydride and phthalic anhydride for use in plasticizers and alkyd resins are also made in St. Louis. The company's central research department is in Dayton, Ohio.

Sales of Monsanto's consolidated companies, including domestic, Canadian, and Brazilian subsidiaries only, were $143,403,161 in 1947, an increase of $43,812,371 over 1946. Sales figures indicating how much volume is plastics have not been broken down.

The program for the near future contemplates some additional service facilities to meet growing requirements for power and for warehouse space, but Monsanto has no major plant construction programs scheduled. (*To page* 154)

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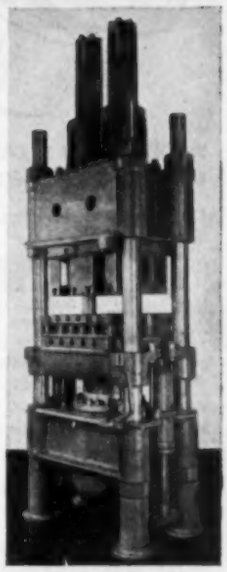

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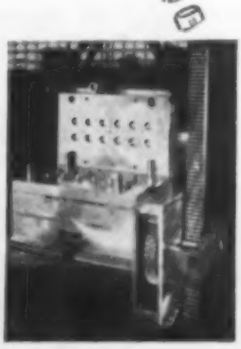

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Nixon Nitration Works produces cellulose nitrate, cellulose acetate, and ethyl cellulose in the form of sheet, extruded rods, tubes, shapes, and molding material, at its plant in Nixon, N. J., near New Brunswick.

The company has announced no expansion program since the close of the war but reports that it has sufficient facilities to handle any normal demand for these cellulosic materials.

Plaskon Div., Libby-Owens-Ford Glass Co., completed its new Glendale plant just outside Toledo, Ohio, in 1947. At this plant the company has considerably increased its capacity for manufacturing urea and melamine molding compounds and synthetic resin coating compounds for the paint and varnish industry. Also at this site are a pilot plant and research facilities. The older Sylvan Avenue plant in Toledo is devoted entirely to the manufacture of urea resin glues.

Reichhold Chemicals, Inc., produces phenolic resins at its home plant in Detroit, Mich. New plants have been opened in Seattle, Wash., for phenolic adhesives; in Tuscaloosa, Ala., for color pigments; and in Elizabeth, N. J., for maleic anhydride.

Reilly Tar & Chemical Corp., producer of phenol formaldehyde molding powder and varnishes, is still operating at about the same capacity as during the war for these particular compounds but expects to have completed an addition to its molding powder capacity before the end of 1949. The phenol formaldehyde plant is in Newark, N. J.

The company also produces cresylic acid at Indianapolis, Ind., and Newark, N. J., and crude naphthalene (the basic material from which phthalic anhydride is produced) at Fairmont, W. Va., Cleveland, Ohio, Chicago, Ill., and Granite City, Ill. It expects demand for these chemicals to exceed supply in 1949.

Tennessee Eastman Corp. expanded its plastics production facilities greatly during the period of 1945-1947. No further expansion was made during 1948, nor is any anticipated at present.

Tenite I and Tenite II are manufactured at Kingsport, Tenn., as is also the base material for Kodapak, a cellulosic film or sheet. Kodapak is manufactured by Eastman Kodak Co. at Rochester, N. Y.

The parent company's (Eastman Kodak Co.) annual statement gave an interesting breakdown of company sales in 1947. Its total sales were $352,000,000 in comparison to $275,000,000 in 1946. Cellulose esters products, the majority of which are made at Kingsport, accounted for 23% of the company's sales and included acetate yarn and staple fiber, acetate sheeting, plastic compounds, etc. Fifty-five percent of the parent company sales were in amateur

and commercial photographic equipment, including films, apparatus, accessories, etc. Professional motion picture film accounted for 9% of total sales. Since photographic and motion picture film is either acetate or cellulose nitrate, it is easily seen that this item, not generally counted in plastics volume, is of large proportions.

Eastman Kodak Co. employment at the close of 1947 was 33,100 in Rochester and 9000 in Kingsport.

The Year in Review

(*Continued from page* 112)

concerning the degradative reactions of plastics, (315-317) resistance to fungi (318, 319) and grease, (320) and surface energy relationships. (321, 322) A forerunner of many similar investigations to come described the effects of subjecting polymeric materials to uniformly high concentrations of radiation from a chain reacting nuclear pile. (323)

The theoretical and practical significance of the long time deformation effects in viscoelastic materials, including stress relaxation, creep, permanent set, cold flow, and recovery, to those who manufacture and use plastics was set forth in a valuable contribution. (324) The scratch and abrasion resistance of plastics likewise received expert attention. (325-327) Many important papers dealt with the strength, (328-330) optical, (331-333) electrical, (334-336) and rheological (337-341) properties of plastics. Other special characteristics reported on included second-order transition points, (342) ignition temperatures, (343) distortion under heat, (344) heats of polymerization, (345) solubility and gel fermation, (346) and molecular structure as revealed by X-ray. (347)

Analysis and identification of plastics were considered in reports concerning cellulose acetate, (348) asphalt, (349) urea resins, (350) polystyrene, (351) and polymers containing unsaturated bonds. (352-354) Special techniques developed for evaluating plastics and other high polymers made use of magnetochemistry, (355) the electron microscope, (356) polarized light, (357, 358) shear vibrating crystals, (359) and viscometry. (360) Various methods and machines were described for measuring stress-strain properties, (361-364) impact strength, (365) tear resistance, (366) hardness, (367) low temperature brittleness, (368) refractive index, (369) transparency, (370) and water absorption. (371)

The American Society for Testing Materials revised its specifications for polystyrene, methacrylate, and cellulose acetate molding compounds and laminated thermosetting materials. (372) New test methods were adopted for apparent density and bulk factor of nonpouring molding powders (D 954-48T), measuring shrinkage from mold dimensions of mold-

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ed plastics (D 955-48T), and bond strength of plastics and electrical insulating materials (D 952-48T). Recommended practices were approved for molding specimens of amino plastics (D 956-48T), determining mold surface temperatures of commercial molds for plastics (D 957-48T), and determining temperatures of standard A.S.T.M. molds for test specimens of plastics (D 958-48T). Committee D-14 on Adhesives has approved a test for impact strength of adhesives (D 950-47T) and has prepared definitions of terms relating to adhesives (D 907-48T). (373)

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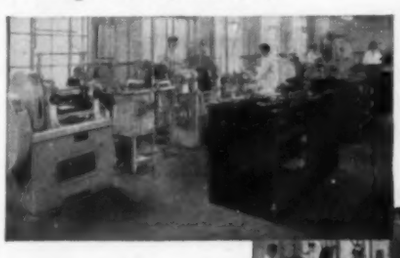

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Correction

In the article "Grading of Sheet Plastics By Moisture Absorption and Insulation Resistance Measurements," starting on page 127 of the December issue of MODERN PLASTICS, the two photographs used to illustrate the text were inadvertently transposed. The photograph on page 127 should be captioned "2—Apparatus used to make insulation resistance measurements"; the photograph on page 168 should be captioned "1—Apparatus used to make moisture absorption measurements."

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By R. L. VAN BOSKIRK

Shipping costs

THE plastics industry is in for some headaches and perhaps an adjustment upwards in both motor and rail freight rates, according to a bulletin issued by The Society of the Plastics Industry, Inc. The bulletin declares that in too many cases the ratings on plastics articles have been moved sharply higher than competing non-plastics commodities on the basis of their relative lightness, value, or other classification determining characteristics.

The S.P.I. Traffic Committee, headed by B. A. Butryman, Colt's Manufacturing Co., has sponsored appeals for lower ratings where the items were of national significance, but the committee cannot concern itself with local rulings or with rating changes on items of concern only to one or two companies. The committee did successfully oppose a motor carrier proposal to increase rates on plastic games and toys.

At the present time the committee is attempting to obtain a reduction in a proposal of the classification board which took plastic radio cabinets from the same rating as metal or wooden cabinets and forced them into a higher rate class. The committee is also trying to have plastic tableware placed in the same rating as china and will contest a rating on buttons which would place them in first rather than second class.

Perforated vinyl

FOR a long time the vinyl industry has been interested in a sheet that can "breathe." Its advantages are obvious for such applications as shoe uppers, raincoats, etc. We have trailed several rumors regarding such a process or material.

Many of the trails lead to the door of J. W. Meaker, 280 Broadway, New York, N. Y., who has had some success with electronic perforation of paper for use in multiwall bags. When asked about the possibility of using his method for perforating vinyl film or sheeting, he said that he would be able to perforate vinyl fabrics with 64 holes to the square inch. Since invisibility of the holes is desirable, it is necessary that they be very small and that there be many of them in order to provide for the passage of sufficient air to meet desired needs.

Meaker says that such perforations will make vinyl from 2 to 10 times as porous as natural leather. He states that several plies cannot be perforated simultaneously as can be done with paper; the operation must be performed one sheet at a time. He claims to have attained a perforating speed of about 50 ft. per min. with electric current at 25,000 volts. In running a strip 36 in. wide by 50 ft. long, he reports to have made 1,382,400 perforations per min. in the 21,600 sq. in. involved.

Mr. Meaker says that he has had as yet no long commercial runs of plastic to give him actual experience but that production of 50 ft. per min. would mean 3000 linear ft. of 3 ft. wide material per hr., or 1000 sq. yd. per hr., for about 15¢ worth of current. He says that the physical characteristics of the fabric, whether paper or plastic, are unchanged. The edges of the holes seem to become plasticized, or fused. Tensile strength is usually slightly increased, and tear strength averages about the same.

Meaker's plan of marketing is to license manufacturers to use the process on a royalty basis.

Discontinues nitrate production

MANUFACTURE of all cellulose nitrate plastic products has been discontinued by Celanese Corp. of America, according to W. S. Landes, vice-president in charge of the Plastics Division. Mr. Landes said that "in relationship to other plastics, the position of cellulose nitrate has steadily deteriorated in recent years. In 1931 cellulose nitrate production accounted for more than 90% of the total cellulosics plastics production in the country, but last year accounted for only 13 percent.

"Technological advances in the fields of cellulose acetate, cellulose propionate, and other materials during recent years suggest a further widening of the gap between such materials and cellulose nitrate. Indicative of this is the fact that for some months Celanese has been supplying a new form of cellulose acetate sheeting which has resulted in improvements in manufacturing processes and economies not available before."

Vinyl printing aid

A NON-TOXIC powder is now being employed by vinyl printers to eliminate slip sheeting or interlining. The material, called Craig Dri-Spray powder, has been placed on the market by Payne & Craig Corp., 82 Beekman St., New York 7, N. Y.

N. B. S. lectures

AMONG the lectures to be presented this year at the National Bureau of Standards on the chemical and physical properties of high polymers, are the following of particular interest to research workers in the rubber, leather, and plastics industries. These lectures are open to the public without charge.

Jan. 6—"Rheological Properties of

ALL OF our readers who are in the plastics field should be included in the annual Directory of the 1949 Modern Plastics Encyclopedia. No cost or obligation is involved. Requests for listing blanks should be sent to Directory Dept., *Modern Plastics Encyclopedia*, 122 East 42nd St., New York 17, N. Y.

The listings include materials and chemicals, equipment and supplies, machine tools, machinery, molders, extruders, fabricators, laminators, consultants, company personnel, testing laboratories, industrial designers, molders' markings, trade names, schools, trade associations, available motion picture films, etc.

*Reg. U. S. Patent Office

NEW

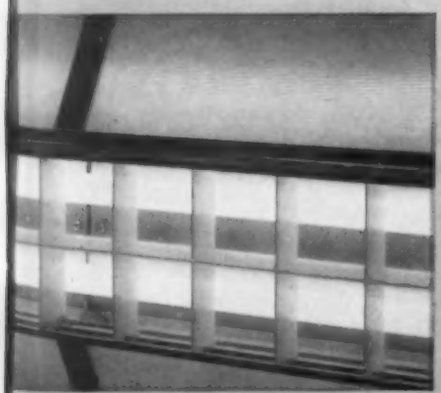
STYRON 637

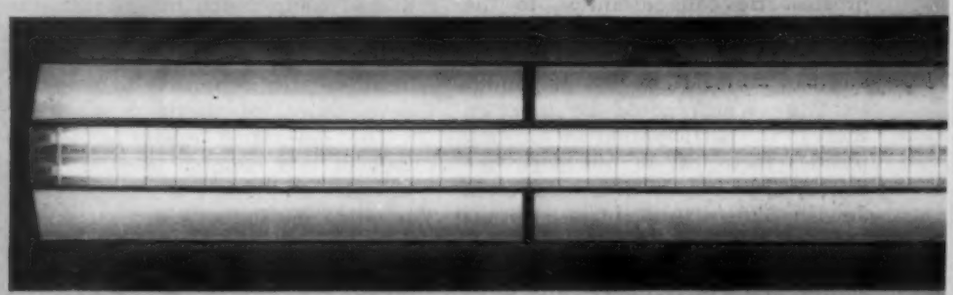
provides greater light stability

This new grade of Dow Polystyrene opens a vast number of new product applications. The increased light stability of Styron 637, in whites and crystals, makes it applicable to fluorescent light fixtures, lamp shades, optical and automotive interior parts. Its resistance to discoloration from light is several times that of previously available polystyrenes.

STYRON 637
used in Fluorescent Lighting Fixtures
insures: • GOOD LIGHT STABILITY • LONGER COLOR LIFE • BETTER LIGHT DIFFUSION

Luminaires by Allen & Olsen Manufacturing Co., Venice, California • Extruder: *Plastic Process Company, Inc., 662 North Robertson Blvd., Los Angeles 46, Calif.*





Styron 637 retains all the excellent properties of Styron, plus offering improved light stability. It is readily extruded and molded into diffusers and structural parts, and maintains its rigidity and dimensional stability in thin, large area sections. Combination of Styron 637 with metal provides attractive fixtures with a major reduction in weight. With Styron 637, extended color life can be added to your lighting specifications.

Contact your nearest Dow Sales Office today for information on how new Styron 637 can apply to your product.

PLASTICS DIVISION T-2 • THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

DOW Plastics

THE PLASTISCOPE

Polystyrene," R. S. Spencer, The Dow Chemical Co.

March 3—"Reactions of Free Radicals with Hydrocarbons," E. W. R. Steacie, National Research Council.

May 5—"The Chemistry of Some Derived Polymers of the Vinyl Series," W. O. Kenyon, Eastman Kodak Co.

Plastics in Palestine

DESPITE all the troubles in Palestine, it is interesting to note how the plastics industry is obtaining a foothold in that country. A letter from E. Huppert, chemical engineer, 10 Melchett St., Tel Aviv, Palestine, tells us that there are now 16 firms in the country engaged in the manufacture of plastic products. Twelve of them are molders and four are extruders.

The injection molding division of the industry is operating one Reed-Prentice 8-oz. machine; two British 2-oz. machines; two Van Dorn 1-oz. machines; one German 1-oz. machine; and four British hand injection molding presses. The thermosetting branch has at its disposal about 20 modern compression presses with 50 to 250 ton capacities.

Mr. Huppert is presently looking for about ten 100-ton hydraulic presses; several 4-oz. injection machines; and two 10-oz. injection presses. He calls attention to the fact, however, that payment in United States dollars is impossible and can only be effected in pounds sterling (which could be invested there); by participation in existing plastics factories; in mortgage debentures; in industrial shares; or in Jewish State loans. He also thinks the country would be interested in the establishment of both a thermosetting and a thermoplastic molding powder plant and the establishment of a mold making shop.

The incorporation of a new company in Israel, which has been named the Supercon Resinous Chemical Corp., Ltd., and which will manufacture plastics for industrial uses, was recently announced by Harry Levine, Leominster, Mass., and Robert Szold, chairman of the board of directors of the Palestine Economic Corp. Capital equivalent to $250,000 has been subscribed; factory space has been obtained; machinery and raw materials have been ordered here and have probably been shipped by this time.

Training plastics engineers

THE formation of a Services Advisory Committee to consult with the Plastics Committee of Princeton University on the needs of the Army and Navy in plastics research has been announced by Professor Louis F. Rahm, director of the Princeton University Plastics Laboratory. Prof. Rahm is chairman of the S.P.E. Educational Committee which has been working on the problem of the proper training of professional plastics engineers.

The new committee will meet quarterly in Princeton and is composed of four representatives of the Army Signal Corps and two representatives each of the Office of Naval Research, the Navy Bureau of Ships, and the Navy Bureau of Aeronautics.

Indian plastics delegation

AT a press reception held by the Omni Export Corp. for the delegation of the All India Plastics Manufacturers Association, members of the group expressed the opinion that injection molding progress in the United States has outstripped that of compression molding. It was their belief, also, that the United States is far ahead of other nations in all around technical and scientific development of plastics.

The delegation made a month's tour of this country late last year in order to prepare a memorandum to guide the Indian plastics industry in its industrial progress. The group was particularly interested in the molding and fabricating industries because it is hoped that a domestic industry to supply all India's plastics needs will be developed. They will buy raw materials and machinery in this country until such time as more plants can be developed in India.

Spokesmen for the delegation said that India now has a 3000-ton annual capacity for compression materials and 30 to 40 injection presses, with more on the way. The country has a 1,500,000-ton steel production which is expected to go up to 3,000,000 or 4,000,000 tons in a few years; the accompanying coke processing plants should be capable of supplying all the coal tar chemicals that might be needed by a plastics raw materials industry in India within a few years' time. There might even be some surplus of such products as benzol and naphthalene for export.

Koppers Co., Inc., is reported to be interested in the construction of a coal tar chemical plant in India. There is also a belief that some firm as yet unidentified will erect a vinyl plant in India within the next three years.

India, like nearly all other foreign countries, is short on dollars but points to its exports of manganese, shellac, and cashew nuts as materials needed in the United States which can be exchanged for dollars. The cashew nut volume alone is reported to be somewhere around $10,000,000 annually.

New house organs

NEARLY all the major producers of raw materials and synthetic resin are now publishing house organs designed to serve as publicity and information media to present and potential customers. One of the latest to appear is *The Plaskon Magazine*, published by the Plaskon Div., Libbey-Owens-Ford Glass Co., Toledo, Ohio. It is a particularly well printed brochure with a larger format than most comparable publications, thus giving more scope to dramatic illustration.

The editor states: "As a maker of materials and ingredients rather than 'finished products,' the successful sales promotion of Plaskon products is often dependent upon an equally successful promotion of the sales of others. It is to achieve this two-in-one aim that *The Plaskon Magazine* has been established."

The magazine is edited by Wyatte Hicks, and the design and typography is by Ariosto Nordozzi. Among the articles in the first issue are complete stories on Plaskon's new alkyd molding compound, the Telex hearing aid with printed circuit, and the use of Plaskon glues with plywood.

"This Formica World," is the name of the external house organ published for the first time in October by The Formica Co., Cincinnati, Ohio, manufacturers of decorative and industrial laminated plastics. The magazine is published quarterly and is designed to acquaint customers, potential customers, stock-

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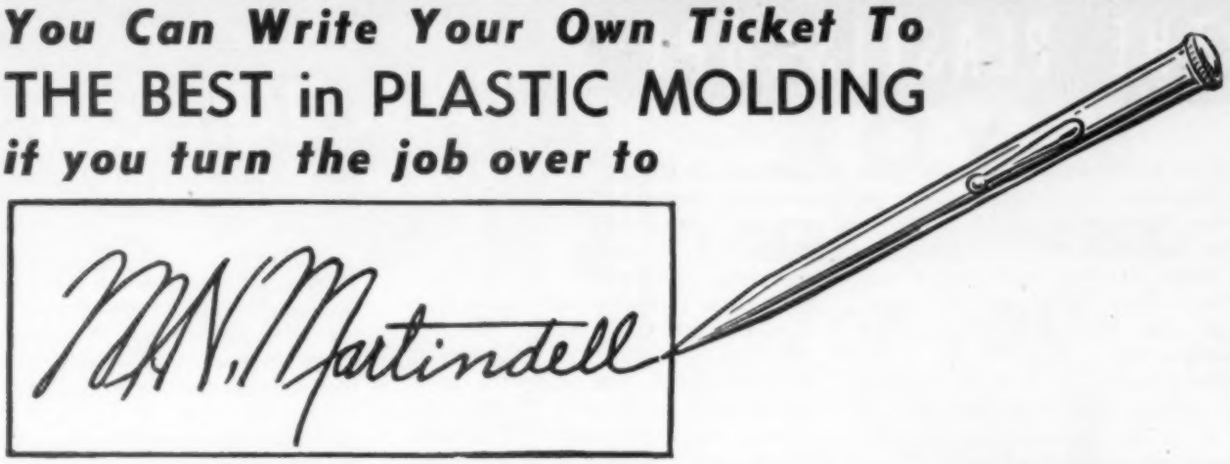

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THE PLASTISCOPE

holders, and employees with new developments and applications of Formica products.

The first issue featured a 4-page, full color pictorial tour of the new Terrace Plaza Hotel in Cincinnati, where the company's decorative materials are widely used. Other articles cover the uses of Formica post formed industrial laminates in the F-86 jet fighter plane, in the transportation industry, and in Cincinnati's Good Samaritan Hospital.

School of plastics

IMMEDIATELY following World War II many veterans and other people entered various phases of the plastics fabrication business. There were so many failures, largely because of lack of basic knowledge, that educational facilities became an obvious need. One of the groups that was formed to supply this need was the Enterprise School of Plastics, Brooklyn, N. Y., organized in May 1947.

The objectives of the school, which is licensed by the State of New York and is approved for veterans under the G. I. Bill of Rights, are to teach efficient operation of fabricating equipment; to introduce methods, operations, and materials associated with the fabrication of plastics; and to familiarize students with shop layout, operation, and maintenance.

Work at the school is divided into two major phases: class and individual shop work; and lecture and demonstration as applied directly to shop work. Two courses are presented: general fabrication and specialized fabrication. The general fabrication course gives the student instruction in machines and procedures for producing plastic products for sale to various sources. The specialized fabrication course gives the student more concentrated attention in the particular operation or phase of the work which he chooses to follow.

The school maintains a placement service for its students and graduates but does not guarantee employment to those who take instruction.

COMPANY NEWS

Just Plastics, Inc., has moved to new and larger quarters at 256 W. 65th St., New York 23, N. Y.

Marshall-Bryan, Inc., is a new company organized to produce high strength reinforced plastics at 65 Dale Ave., Ossining, N. Y. J. R. Marshall, president of the new concern, was formerly associated with the Plastics and Resins Div. of America Cyanamid Co. R. C. Bryan, vice-president, was formerly associated with the General Electric Co., where he supervised the Plastic Development Laboratory at Pittsfield, Mass.

Daystrom Corp., Olean, N. Y. has announced a reduction in its work week from an average of 43 to 36 hours. A seasonal decline in orders is reported to be the reason for cutback.

U. S. Fiber and Plastics Corp., Stirling, N. J., has announced the appointment of Walter J. A. Connor as sales manager. Mr. Connor has resigned as assistant eastern district sales manager of the Chemical Div., Koppers Co. He began his merchandising career as an assistant to the street floor merchandising manager of Jordan Marsh Co., Boston, Mass., and later sold plastic molding powder for the Celanese Corp. of America until he became vice-president of the Chemaco Corp.

The company with which Mr. Connor is now associated is one of the pioneers and specialists in the manufacture of electronically welded inflatable plastic articles, such as toys, water and mildew-proof mattresses and cushions, water wings, sea horses, etc. Mr. Connor points out that he is moving into a comparatively new field, the surface of which has scarcely been scratched so far as production of plastic products is concerned.

Bjorksten Research Laboratories has leased space at 323 W. Gorham St., Madison, Wis., for additional research although the main office and laboratory remains in Chicago. The move was made to decentralize activities of Bjorksten, developers of the Logoquant treatment for polystyrene.

Igard Corporation of America, 146 E. 35th St., New York, N. Y., was recently formed to handle American sales of plastic ophthalmic lenses and other optical products manufactured by Combined Optical Industries, Ltd., London, England. The lenses are said to be shatterproof, lighter than glass, and capable of resisting the "fogging" commonly associated with ordinary eyeglasses. Gordon F. Ives, formerly manager of the Import Div. of Westinghouse Electric International Co., has been named president of the new corporation.

Douglas Fir Plywood Association, Tacoma, Wash., has begun construction of a new laboratory at Eugene, Ore., in an expansion of its facilities for testing Douglas fir plywood. The Eugene laboratory will be headed by Robert H. Ripley, now in the technical department of the plywood association.

Plastics Production, Inc., of New Orleans, La., has moved to larger quarters at 322 Tchoupitoulas St., and has announced a change in officers. Aruns Callery was elected vice-president, and Killian Huger, secretary-treasurer. Erwin Reveri has been appointed production superintendent.

Die-Mold Corp. has moved into its new plant at 6619 Motor Ave., Milwaukee 13, Wis.

Hercules Powder Co., Wilmington, Del., has announced the following personnel changes in its Cellulose Products Dept.: Carl W. Eurenius has been named director of sales for the department to succeed J. B. Wiesel, who has become assistant to the general manager. A. R. Olsen has been named manager of plastics promotion.

Plaskon Div., Libbey-Owens-Ford Glass Co., Toledo, Ohio, has announced the appointments of Charles L. Neely as sales manager of glues and industrial resins and Donald Delaney as assistant sales manager of coating resins. Mr. Neely represented Plaskon in the southeastern area with headquarters at Greensboro, N. C., before coming to the Toledo offices. Mr. Delaney has just joined Plaskon and was formerly with the Atlantic Refining Co. and Du Pont.

Watson-Park Co., 261 Franklin St., Boston, Mass., has completed a formaldehyde plant designed particularly to serve New England customers. Production began last August and has increased steadily each month since then. The Watson-Park Co. started business in 1925 as brokers for textile chemicals and dyestuffs and has enlarged steadily over the last two decades. The company

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Molds, made from Carpenter VEGA Tool Steel, built and operated by BEAMAN PLASTICS PRODUCTS CO. for SAWYER'S, INC., Portland, Ore.

Specifications were exacting for these large molds used to make the View-Master box which houses photographic equipment. Because the top and bottom of the box had to match perfectly, mold size change had to be held to an absolute minimum. Also, the molder wanted double assurance that every box would come through with a gleaming finish. With Carpenter *Vega*, size change was held to less than .0003"—and the finished boxes are real beauties!

For similar performance on your large molds where minimum size change is important, always specify "Carpenter Vega". THE CARPENTER STEEL CO., 112 W. BERN ST., READING, PA.

Job Statistics:

Vega was machined to 1/32" of final size; then stress relieved by heating to 1000°F, and cooling slowly. After final machining and polishing, molds were reheated to 1550°F, held at this temperature for 4 hours, then cooled in air. Drawn overnight at 400°F. Resulting hardness: Rockwell C-58.

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THE PLASTISCOPE

has a plant in Lowell Junction, Mass., which has a tank storage capacity of 200,000 gallons. Research and analytical laboratories, added from time to time, specialize in chemical products used by textile companies.

Standard Tool Co., Leominster, Mass., has opened a Stan-Cast Div., for casting mold cavities in any type of steel or beryllium alloy. The company developed the casting process for its own use and has expanded its facilities to take on additional outside work.

MacMillin Engineering Corp. has opened new enlarged offices at 6806 N. Clark St., Chicago 26, Ill. This firm of consulting engineers specializes in hydraulically operated machinery, oil-hydraulic power systems, and components.

Ferro Chemical Corp., P. O. Box 76, Bedford, Ohio, has announced the death of its president, W. B. Lawson on September 28 last. The new company officers include C. D. Clawson, president; F. S. Markert, executive vice-president; G. W. Wallace, treasurer; S. B. Elliott, assistant to the president,; and D. L. Cable, vice-president.

The company recently moved its offices from Cleveland, Ohio, and has centralized all operations, including sales and administration, to its Bedford plant.

Bishop Gutta Percha Co., 420 E. 25th St., New York 10, N. Y., has announced a new self-bonding electrical insulating tape called Bi-Seal. It is a blend of synthetic polymers and resins and is compatible with butyl rubber, polyethylene, and vinyl resins. Its dielectric strength is said to be better than 1000 volts per mil of thickness; aging characteristics are reported as good; and its resistance to ozone, moisture, acids, and alkalies is rated as exceptional. The new tape is available in 1 lb. rolls of any desired width in a standard thickness of 0.020 inches.

Aviatrix Corp., 168 W. 23rd St., New York 10, N. Y., has placed metallic vinyl film typewriter covers on the market in sizes from 10 in. to 26 inches. They may be obtained in silver or black, priced from 33 to 70 cents.

The Monarch Machine Tool Co., Sidney, Ohio, has established a sales office in the Roselawn Center Bldg., Cincinnati, Ohio. Frank Heap has been transferred from Indianapolis to the new office to head an expanded Cincinnati-Indianapolis sales territory. Don Potter, formerly assistant to Mr. Heap, is now in charge of the Indianapolis office.

Excelsior Springs Plastics Co. recently began operations with two 9-oz. HPM injection machines, with another 9 oz. and a 16 oz. planned for the near future. The plant is located at 205 N. Marietta, Excelsior Springs, Mo. One of its first jobs was turning out plastic gunstock parts for the Bishop Gun Co.

Kenneth Baumgart is president and Bob Gray is chief engineer of the new company, which is a subsidiary of the Injection Molding Co., Kansas City, Mo.

Plaskon Div., Libbey-Owens-Ford Glass Co., Toledo, Ohio, has divided its Chicago sales zone into two areas. James Ferguson is district manager of Zone I, south of Chicago, and will have management of the Chicago office at 400 W. Madison St. G. T. Walker, Jr., is district manager of Zone II, north of Chicago.

Plastex Machine Corp., Paterson 27, N. J., manufacturers of direct extrusion takeups for monofilaments and flat strips, has announced the appointment of Omni Products Co., New York, N. Y., as exclusive export distributors of the complete Plastex machine line.

Hercules Powder Co. has announced that Dr. Peter Van Wyck has been appointed technical assistant to the Hercules director of research. Dr. Van Wyck was formerly manager of the Virginia Cellulose Div. of the Hercules Experiment Station. Dr. Richard E. Chaddock, who has been handling technical assistance in this field, has now taken over responsibility for technical assistance on sales development. Dr. Arthur F. Martin has replaced Dr. Van Wyck as manager of the Virginia Cellulose Div. at the Experiment Station; E. L. Jones has succeeded Dr. Martin as chief chemist of the Virginia Cellulose plant in Hopewell, Va.

Consolidated Products Co., Inc., 15 Park Row, New York, N. Y., has purchased all the machinery and equipment of the Atlas Powder Co.'s Coated Fabric Div. of its Zapon plant in Stamford, Conn. This plant, originally installed at a cost of $2,000,000, occupies 300,000 sq. ft. of floor space. As announced last month, Atlas Powder Co. has discontinued the manufacture and sale of coated fabrics in its Stamford plant. Consolidated Products Co. is undertaking the liquidation of the machinery to the paint, ink, varnish, lacquer, chemical, textile, plastic coating, rubber, artificial leather, and allied industries.

PERSONAL NEWS

Carl H. Pottenger, assistant manager of the Plastics Dept. of American Cyanamid Co. since 1947, has joined Koppers Co., Inc., as an assistant sales manager of the Chemical Div., with headquarters in Pittsburgh, Pa. Mr. Pottenger was formerly a vice-president of the Pennsylvania Coal Products Co. of Petrolia, Pa., which was purchased by Koppers in 1947.

Richard W. Schreck has been appointed Michigan divisional sales representative for the Watson-Stillman Co. He will work out of the company's Chicago, Ill., office, under the direction of F. G. Helander, district manager in charge of midwestern sales.

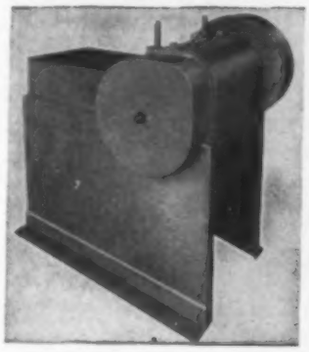
Norman R. Davis, recently chief engineer of Gemloid Corp., Elmhurst, N. Y., has assumed a similar post with Majestic Molded Products, Inc., 22-01 41st Ave., Long Island City 1, N. Y.

E. W. Cronin, formerly with the Chicago, Ill., office of the Plastics Dept., E. I. du Pont de Nemours & Co., Inc., has joined Kent Plastics Corp., 1528 N. Fulton Ave., Evansville 10, Ind., as plant manager. The Kent organization specializes in the injection molding of custom decorative plastic parts.

H. E. Selby, formerly in charge of the McCordi Corp. research laboratories, has been appointed research director for the Bishop Gutta-Percha Co., 420 E. 25th St., New York 10, N. Y. *(Turn to next page)*

Cumberland Machines for the Plastics Industry

New!



CUMBERLAND ROTARY CHOPPING MACHINE

This machine cuts slab material from compounding mills, chops continuously extruded rods, sheets or stands, and cuts up calender roll side shear strips. This machine is also used in conjunction with extrusion machines to produce cube or pellet material suitable for a molding compound.

CUMBERLAND SLITTING & MANGLING MACHINE

This machine is useful primarily to manufacturers who compound plastic materials. The machine may be used to reduce material for use as a commercial product without further granulating. Or it may be used to prepare material for subsequent final reduction in a granulating machine.

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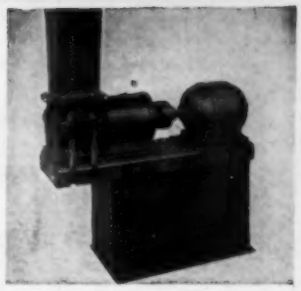
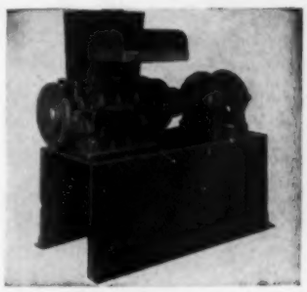
These machines are designed especially for plastics. They perform with high efficiency the special cutting requirements of plastic materiuls. They are simple in design, rugged in construction and are easy to dismantle and clean. These machines are built in two styles. Nos. 0, ½ and 1½ as at top right (No. ½ is illustrated). Also, large 18" machine, double hung, with retractable knife block for complete accessibility. (Illustrated at right below.)





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THE PLASTISCOPE

Dave Thomas has been named vice-president and general manager of American Insulator Corp., New Freedom, Pa. He was also appointed as a director of the corporation. C. M. Norris was named vice-president in charge of sales at the same time.

James B. Holland, II, has been appointed sales manager of the Taylor Fibre Co., Norristown, Pa., manufacturers of laminated plastics. Mr. Holland started with Taylor Fibre as an apprentice in the plant in 1939.

James A. Doherty has been promoted to sales manager of the Proprietary Sales Div. of Consolidated Molded Products Corp., Scranton 2, Pa.

Christian B. Haas has joined the operating staff of The Standard Products Co., Plastics Div., St. Clair, Mich. He replaces C. M. Green, recently resigned.

Charles F. Hamilton has been transferred from the western Pennsylvania office of Kurz-Kasch, Inc., to its Chicago territory, with headquarters at 608 S. Dearborn St., Chicago, Ill.

Harry F. Pfann has been named manager of the Chemical Development Section, Chemical Div., Koppers Co., Inc., Pittsburgh, Pa.

Sam Gurley, Jr., has been appointed sales manager of Durite Plastics, a part of the Chemical Div. of the Borden Co. He is located at the Durite executive offices, 5000 Summerdale, Philadelphia 24, Pa.

Maurice Fleishman has resigned as plastics engineer for the Motor Products Div., United States Rubber Co., Detroit, Mich., with which he has been associated for the past 6 years. His future plans have not yet been announced.

Richard Harrison, sales manager of Formold Plastics, Inc., 3145 S. Wabash Ave., Chicago, Ill., has resigned from the firm.

Arthur L. Lahey has been appointed Pacific Coast sales manager of Interlake Chemical Corp., Cleveland, Ohio. Mr. Lahey's headquarters are at the company's new Office and Plywood Testing Laboratory, 1720 S.W. Harbor Dr., Portland, Ore. Interlake has long been a large supplier of glue used in manufacturing plywood.

J. T. Gillespie, Jr., has been appointed sales manager of the Watson-Stillman Co., Roselle, N. J. The previous sales staff remains unchanged.

Dr. Gilbert Thiessen has been named technical advisor for the Chemical Div., Koppers Co., Inc., Pittsburgh 19, Pa. E. Y. Wolford succeeds Dr. Thiessen as manager of plastics development for the company's Chemical Division.

Dr. James R. Donnalley has been named manager of the General Electric Co.'s silicone manufacturing plant at Waterford, N. Y.

Thomas J. Martin has been appointed branch sales manager at Detroit, Mich., for the Plastics Div., Monsanto Chemical Co., replacing Carl H. Whitlock, resigned. Mr. Martin was formerly branch sales manager at St. Louis, Mo., and is succeeded by Jack W. Porte who was assistant branch sales manager at Chicago, Ill.

C. D. Kerr has been appointed sales representative for Ohio, Michigan, Indiana, and Kentucky by A. Bamberger Corp. and its manufacturing affiliate, American Molding Powder and Chemical Corp., Brooklyn, N. Y. Mr. Kerr will have his headquarters in Cleveland, Ohio. Activities will include the sale of Ampacet cellulose acetate and polystyrene molding powder, as well as purchases and sales of thermoplastics materials for A. Bamberger Corp.

Deceased

Henry Williams, treasurer of the American Insulator Corp., New Freedom, Pa., died Nov. 19.

MEETINGS

Jan. 10-14—American Society of Mechanical Engineers conference on materials handling, Convention Hall, Philadelphia, Pa.

Jan. 12-14—Fourth Annual Technical Session of the Reinforced Plastics Div., The Society of The Plastics Industry, Inc., Edgewater Beach Hotel, Chicago, Ill.

Feb. 15-16—Annual Conference, The Society of the Plastics Industry (Canada) Inc., Niagara Falls, Ont., Can.

Feb. 26-March 4—Spring meeting and Committee Week of the American Society for Testing Materials at Hotel Edgewater Beach, Chicago, Ill. Annual meeting will be held June 27 to July 1, inc., at Chalfonte-Haddon Hall, Atlantic City, N. J.

March 17-19—Annual Pacific Coast meeting, The Society of The Plastics Industry, Inc. Place to be announced.

May 10-13—Eighteenth Annual National Packaging Exposition in the Public Auditorium, Atlantic City, N. J. Annual four-day American Management Association Conference on Packaging, Packing and Shipping will be held in the Auditorium May 10-13, concurrent with Exposition.

May 26-27—Annual meeting, The Society of The Plastics Industry, Inc., Edgewater Beach Hotel, Chicago, Ill.

S. P. E. Meetings

Jan. 12—Newark Section, Newark Athletic Club. Dinner meeting 7 p.m. Speakers will be Robert Burns of Bell Telephone Laboratories, New York, N. Y., and Emile Mc K. Beekman of Signal Corps Engineering Laboratories, Fort Monmouth, N. J. Their subject will be "Selecting the Right Plastic Material."

Jan. 19-21—Annual National Technical Conference, Society of Plastics Engineers, Inc., Hotel Bellevue-Stratford, Philadelphia, Pa.

Jan. 21—Buffalo Section, Park Lane Restaurant, Delaware Ave. at Gates Circle, Buffalo, N. Y. Dinner meeting at 7 p.m. Speaker will be Herbert Spencer of Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y. His subject will be "Selling is Telling and Telling."

Jan. 28—Cleveland Section, Akron, Ohio. Speaker will be Fred Wehmer of Minnesota Mining & Mfg. Co., St. Paul, Minn. Mr. Wehmer's subject will be "Engineering Aspects of Adhesives."

Introducing

SILKYSOL
SILCYL

2 GREAT NEW PLASTIC MATERIALS WITH UNLIMITED APPLICATIONS

When you examine these exciting, outstanding triumphs of plastics chemistry and engineering, you'll be amazed by their rich, pure color, their luxurious, silken texture and dull sheen.

SILKYSOL* is a rayon fabric with a unique, waterproof plastic coating. Entirely odorless, Silkysol has extreme strength, is resistant to dirt, grease, acids and sunlight and is non-fading. It will not crack or peel, for the coating is securely bonded to the fabric base. Silkysol can be cut, sewn, glued — in fact, treated like any other fabric for fabrication purposes.

SILCYL* is the same superbly coated material, laminated to quality vinyl sheeting — with a layer of silky Fiberglas insulation sandwiched between. It is resilient, heat resistant, and can be fabricated in the same manner as Silkysol.

Uses to which you can put Silkysol and Silcyl are almost limitless. They are excellent for rainwear and umbrellas, for luggage and handbags, for upholstery and lawn and beach furniture. You can use them for draperies, wall coverings and other decorative effects. Employment as button or buckle covering, as package lining, as bookbinding cloth are additional suggested applications for these unusually versatile materials.

Both Silkysol and Silcyl come in a full range of solid and pastel colors with smooth, brocade, herringbone or gabardine finish. Standard widths and various weights are available.

EXAMINE SAMPLES YOURSELF
Swatches of Silkysol and Silcyl are available for testing at no cost.
Write for them today.

HERIBERT, INC.

155 Waverly Place New York 14, N. Y.

CHelsea 3-5676-5588

"ONCE A PIONEER . . . ALWAYS A PIONEER" *

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All classified advertisements payable in advance of publication. Rates: $5.00 up to sixty words; enclosed in border, $10.00 per inch.

Classified Advertisements

For further information address Classified Advertising Department, MODERN PLASTICS, 122 East 42nd Street, New York 17, New York

MODERN PLASTICS reserves the right to accept, reject or censor classified copy.

EMPLOYMENT • BUSINESS OPPORTUNITIES • EQUIPMENT (USED OR RESALE ONLY)

WANTED: PLASTIC Scrap or Rejects in any form. Cellulose Acetate, Butyrate, Polystyrene, Acrylic, Vinyl Resin, etc. Also wanted surplus lots of phenolic and urea molding materials. Custom grinding and magnetizing. Reply Box 318, Modern Plastics.

FOR SALE Hydro Pneumatic Accumulator, 13 Gal. 3500#. Ball & Jewell Rotary Cutter. Model R and "T" Stokes Tablet Machines. 50 Ton Press with 18" x 18" Electric Plates. 100 ton 20" x 20" press. Racine Pumps, Boosters, Valves, Logan Pumps, Valves. Self-Contained—200 H.P. 78 Gal. 3000# Pump. 200 H.P. 200 Gal. 1500# Pump 18" x 15'. Accumulator 1500#.—15" x 11' Acc. 400-2000". 6" x 9' Accumulator-2000#. 300 Ton Press 20" Ram, 8" Stroke, 24" x 30" Platen. 500 Ton—1000 Ton Hobbing Press—Heie Shaw Variable Pressure 33 GPM 2500#—Vickers Oil Pumps 17 GPM 500 to 1000#. Elmes Horo. 4 Plunger 6—Gals. 5000#. Stillman 12" x 12" Laboratory Presses. Aaron Machinery Co., 45 Crosby St., NYC.

FOR SALE: Farrel Birm. 14" x 36" 2 Roll Rubber Mill; Royle #2 Perfected Extruder; 500 ton Hydr. Molding Press 42" x 48"; Field 500 ton 25" x 30"; Francis 200 tons; 24" x 18". Albert 100 Ton, 2 opening, 24" x 24"; Stokes 15 Ton, Type 200 Automatic Molding Press. Also presses 20 to 250 tons from 12" x 12" to 36" x 36" & 40 ton Broaching Press. Watson-Stillman Hor. 4 plgr. 1"x2" x 4" H. & L. Pressure Pumps; HPM 1⅝" x 6"; vertical triplex 10 GPM 2700 lbs.; 7 Hydr. Oil Pumps, Vickers, Oilgear, Northern, etc., Elmes 1" x 4" & 1¼" x 4" hor. 4 plgr. 5 to 8 GPM 4500 lbs. & 5500 lbs., Elmes 2" x 6" hor. 30 GPM, 2500 PSI.; Rumsey 4½" x 8" vert. Triplex 65 GPM 900 lbs.; Elmes 2½" x 4" hor. 17 GPM 850 lbs.; Hydr. Steam Pumps; Low Pressure Pumps 150 to 600 lbs. Hydr. Accum.; Stokes Rotary Preform Tablet Machines 1-3/16", 1¼" and ⅝", also single punch; Injection Molding Machines 2 oz. to 12 oz.; Baker Perkins Jacketed Mixers 200, 100, 50, 20, 9 & 0.7 gals. capacity; New and used Rotary Cutters; Rubber Mills; Calenders, Banbury Mixers, etc.; Heavy duty Mixers; Grinders; Pulverizers; Gas Boilers, etc. PARTIAL LISTING. WE BUY YOUR USED MACHINERY. STEIN EQUIPMENT CO., 90 WEST ST., N. Y. 6, N. Y. WOrth 2-5745.

HYDRAULIC PRESSES BUILT to specifications for Plastic Items. Record Presses, producing two per min. We have in the used equipment (1) 1000 ton 30 x 30, 20" ram, 14" stroke, 24" day-light $1800. (1) 600 ton 40 x 48, 18" ram, 36" stroke, 12' day-light $2200. (1) 500 ton 22 x 48, 18" ram, 24" stroke, $1800. (1) 400 ton 22 x 30, 16" ram, 18" stroke, day-light 36" $1500. (2) 200 ton, 42 x 46, 12" ram, 36" stroke, 48" day-light $1200 each (2) 30 ton, 11-½ x 11-½, 10" ram, 10" stroke, 3 post downward acting self-contained $1000.00 each. Sal's Press, 388-390 Warren Street, Brooklyn 2, New York. MAin 4-7847.

MANUFACTURING PLANT—Plastic Molding and Laminating—Over $75,000 in equipment and inventory. Capable of $1,000,000 annual production. 11 Presses 75 tons to 500 tons. Located St. Louis, Missouri. Owner retiring. Will finance up to 50 per cent for responsible firm or individuals. Reply Box C790, Modern Plastics.

WANTED: MOLDS (all items) and Machines: Injection, Transfer, Extruding. Can act quickly and pay cash if you describe fully naming: Maker, Serial Number, Age, Condition, Capacity, Where seen, Lowest Price, and also Wt. of molded part or picture of piece from molds. Are samples available? Reply Box C733, Modern Plastics.

ATTENTION
TOY MANUFACTURERS

Experienced Toy Representative, 200 Fifth Avenue, wants one good line—Easter line or other.
Have excellent buyer contacts, varied promotional ideas. Work on basis of guaranteed sales or no deal. Reply Box C804 Modern Plastics.

PLASTICS SCRAP REPROCESSING
Regrinding, milling, coloring and compounding of plastics scrap and plastics materials.
A. BAMBERGER CORP. 44 HEWES ST
Brooklyn, N. Y. Tel ULster 5-3887

WANTED TO BUY or lease HPM Injection Molding Machines, 2 ounce, 4 ounce, 9 ounce capacity. Reply Box C780, Modern Plastics.

SAVE WITH GUARANTEED REBUILT EQUIPMENT-HYDRAULIC PRESSES; 30" x 30", 20" ram, 1000 tons, 36" x 36", 19" ram, 425 tons; 30" x 30", 17" dia. ram, 340 tons, 24" x 24", 18" ram, 382 tons; 42" x 42", 10" ram, 250 tons; 30" x 30", 16" ram, 300 tons; 36" x 52", 14" ram, 385 tons; 24" x 24", 14" ram, 192 tons; 36" x 36", 12" ram, 141 tons; 24" x 24", 12" ram, 141 tons; 24" x 26" 10" ram, 118 tons; 20" x 20", 10" ram, 118 tons; 19" x 24", 10" rams, 78 tons; 22" x 15", 8" rams, 75 ton, 15" x 15", 8" ram, 75 tons; 12" x 12", 7½" ram, 50 tons; 12" x 12", 6½" ram, 42 tons; 8" x 9½", 4½" ram, 20 tons; 16" x 16", 3½" ram, 12 tons; PUMPS; NEW DUAL PUMPING UNITS, all sizes, Worthington Triplex 12 gal. 2200#; 4 plunger, 6 gal. 2000#; Watson Stillman Duplex Box type 1 gal. 2500#. Worthington 1 gal. 10000#; NEW LABORATORY 6" x 12" M.D. MILLS; Thropp 16" x 40" M. D. MILL; Extruders; Plastic, NRM size 1½ and 2½ Units; Preform Machines; Stokes R and T, Colton 5 and 5½ T; Mixers; Accumulators, Vulcanizers, etc. UNIVERSAL HYDRAULIC MACHINERY COMPANY, 285 Hudson St., New York 13, New York.

FOR SALE—1—Watson Stillman Hydro-Pneumatic High and Low Pressure System, complete, 3000#; 12—Baker Perkins 100 gallon Plastic Mixers; 1—12" x 12" Press 7" Ram, Steel Heated Platens and Hand Pump attached; 2—24" x 24" Adamson, 10" ram, 2—opening Hydraulic Press; 2—La Pointe Hydraulic Pumps, 150 G.P.M.—2000 lb. pressure direct motor driven to 125 HP AC motors; 1—French Oil Hydropneumatic Accumulator; 1—14" x 24" Press, 9" ram; 2—Royale #3 Perfected Tubers; 1—Royale #½ Perfected Tuber; 1—16" x 42" Thropp Mill; 2—B & J #1 Rotary Cutters; 1—Cavagnaro 2 cylinder 10" diameter Vertical Hydraulic Extruder; 1—Devine #11 Vacuum Shelf Dryer, 17 shelves heated 40" x 42"; 1—Farrell 6" x 12" 2-roll Rubber Mill; 1—48" x 48" 3—opening Hydraulic Press, 4—10" diameter rams, 300 tons; Dry Powdor Mixers; Pulverizers; Grinders; etc. Send for complete list. Box C581, Modern Plastics.

CHEMIST AVAILABLE
COATINGS—LAMINATIONS—IMPREGNATIONS—ADHESIVES

Consulting Technical Director of leading company for the past seven years will be available shortly due to reorganization. Textiles, papers and metals. Rubbers, resins, lacquers and colors. Production or Development. Metropolitan New York only. Reply Box C736, Modern Plastics.

IF YOU HAVE GOOD HYDRAULIC PRESSES with modern pumping equipment for sale send me your specifications of same with photo, and I will see to it that you will get the best price available. Sal's Press, 386-390 Warren Street, Brooklyn 2, N. Y., MAin 4-7847.

ONE 9-OUNCE H.P.M. Injection Molding Machine in good working order, a few years old. Machine can be inspected—operating. One 12-ounce Watson-Stillman Injection Molding Machine, first class condition. Can be inspected operating. Reply C794 Modern Plastics.

PLEXIGLAS SHEETS
For Sale

#260 Green	Masked Both Sides
42" x 40" x .125	Original Pack
Large Quantity	$.72 per sq. ft. in case lots, f.o.b. St. Louis (approximately 800 sq. ft.)

KELLY & COMPANY
2007 Olive St. St. Louis 3, Mo.

POLYSTYRENE WANTED. Odd lots and scrap. Any quantity. Reply Box C797 Modern Plastics.

THOROUGHLY EXPERIENCED MAN in executive sales work desires to make connection with industrial firm in sales or advertising capacity. For past 5 years assistant sales manager for large eastern plastics molder. Prefers metropolitan area, Westchester, or Conn. Reply Box C799 Modern Plastics.

WANTED—
PRODUCTION FACILITIES

Long established, substantial Company has developed two items of wide application, now ready for pilot plant production. Patents are pending. This Company has a sales organization already operating in the field covered by the applications, is interested in considering an association with a laminator or molder who is willing to set up pilot plant operation and who has the facilities for production. Pressures used are low, resins are of the polyester type. This can be a big thing if properly handled. Association would be under a mutually beneficial agreement. Please do not reply unless your company is firmly established, well rated. Reply Box C795, Modern Plastics.

WANTED
MANUFACTURERS REPRESENTATIVES

For largest-selling, nationally known Plastics Grinders consistently advertised in trade papers. Have several Southern, Southwestern, Midwestern and Pacific territories recently opened. Catalogue and promotional material available. Reply Box C801 Modern Plastics.

FOR SALE 500 ton Watson-Stillman Press in excellent condition; 20" x 20" platens; pumping system optional. MICRO METALLIC CORPORATION, 193 Bradford St., Brooklyn 7, N. Y.—AP 7-8493.

WANTED—4-8-24 oz. injection molding machines. Give serial and make. Reply Box C796 Modern Plastics.

SALES REPRESENTATIVE WANTED: Completely equipped Mid-Western plastic fabricator desires to contact salesmen able to produce volume business. Our modern equipment and extensive experience qualify us to back up the sales effort of the right men with first class production in an efficient and economical manner. Restricted territories. Replies confidential. Box C789 Modern Plastics.

(*Please turn to page* 174)

MODERN PLASTICS CLASSIFIED ADS GET RESULTS!

Classified advertisements in MODERN PLASTICS are an effective, inexpensive means for buying and selling used plastics machinery, hiring personnel, finding employment and establishing business contacts. These concise notices are read carefully each month by people with specific wants—that's why they get so many "live" responses.

Here are some typical results from recent MODERN PLASTICS classified advertising:

FOR SALE: 1½" extruder	15 replies
WANTED: 2 or 4 oz. injection machine	7 replies
WANTED: Plastic scrap	23 replies
SITUATION WANTED: Sales executive-engineer	8 replies
FOR SALE: Used molds for children's toys	20 replies
WANTED: Manufacturers' representative	8 replies
HELP WANTED: Molding plant supervisor	6 replies
FOR SALE: Plastic advertising and manufacturing novelty business	8 replies

Results like these occur month after month. Rates are surprisingly low and mail box and forwarding service are available at no extra cost. You'll find further information at the top of the page facing this message.

ABC ABP

MODERN PLASTICS
A Breskin Publication
122- East 42nd Street New York 17, N. Y.

You Can Mold NYLON JOBS

BETTER and FASTER

with these production features of
LESTER PHOENIX
INJECTION MOLDING MACHINES

Because:

a positive and simple cut-off eliminates screen packs and other gadgets . . .

an internal heater delivers effective heat, faster and more efficiently . . .

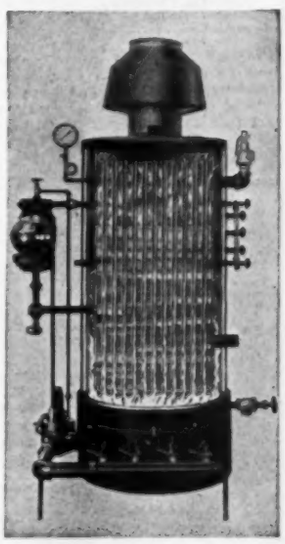
Investigate these and other advantages.

Write us for complete details.

Elmer C. Maywald
& COMPANY Inc., 189 W. Madison St., Chicago 2, Illinois

ENGINEERED
To Meet Your Needs . . .

THE KANE BOILER PACKAGE



The KANE Boiler is built to A.S.M.E. specifications, in sizes to 30 H.P.

. . . it's a compact, self-contained steam source that includes: the correctly sized KANE Automatic Gas-Fired Boiler complete with gas burner and controls to maintain required steam pressure; and an M-K-O Automatic Boiler Feed system designed to return condensate and supply make-up water as required for highest operating efficiency.

Engineered Steam at its best with four decades of experience at your disposal — so, send your steam problem to us for study and recommendation.

ENGINEERED STEAM AT ITS BEST

MEARS·KANE·OFELDT INC.
1903-1915 EAST HAGERT STREET, PHILADELPHIA 25, PA.
FOUR DECADES OF AUTOMATIC GAS-FIRED BOILER MANUFACTURING EXPERIENCE.

(Continued from page 172)

PATENT RIGHTS FOR SALE
MECHANICAL LEAD PENCIL

Basically new design—simple—few parts—two metal parts, others plastic. Write W. J. Parish, R. F. D. #2, Thomaston, Connecticut

FERRACUTE, INJECTION MOLDING PRESS, M 18902, Ser. #22435, with Lucite Hopper, 208 volts, 3 phase Heating Unit. Price $500.00. Reply Box C810 Modern Plastics.

PHENOLIC ROD
For Sale

Quan.	Size	Color Grade	Price
3340'	3/16"x36"	Natural CO	.19 per ft.
1903'	5/8"x36"	" "	.225 pr ft.
958'	3/4"x36"	" "	.61 per ft.
5000'	3/8"x36"	Black XX	.16 per ft.
1864'	1"x1½"x48"	Natural L	.57 per lb. FOB St. Louis

CHECK THE SAVING
KELLY & COMPANY
2007 Olive St. St. Louis 3, Mo.

POSITION WANTED: Now General Manager of Production for five years. All types Plastic Extrusions, tool maker and machinist for fifteen years. Have accounts and proprietary items. Capable of setting up complete Plant and have methods known only to several Extruders. Can Design attachments for Extrusion. Not afraid to roll up my sleeves and work in the Plant. Will Travel—Foreign. Reply Box C802 Modern Plastics.

NEW PROCESS AVAILABLE

for coloring or decorating polystyrene and other thermoplastic products. Gold, silver and colors; scratchproof, alcoholproof, cheap in application and materials. Patents applied for, licenses available. Reply Box C800 Modern Plastics.

ENGINEER, with many years of experience in all branches of plastic articles, desires to represent in Australia all types of plastic materials, machines and raw materials. Is willing to establish and manage such factory. Farkas, 19 Rue Copernic, Paris, 16E/France.

FOR SALE
UNUSED SURPLUS MATERIAL
STILL IN ORIGINAL CONTAINERS

1—Dings 12" wide high intensity type "B" extra strong magnetic separator with cross belts and all other standard parts.
1—Electronic rectifier with insulated transformer, built in time delay relay, pilot light, switch and separate filament transformer.
1—Spare rectifier tube.
1—Model #2-A Jeffry vibrating feeder with 8" x 16" open pan deck and vibrating hopper with rheostat control for operation from 110 volt, 60 cycle, A.C.
1—1 HP 220/440 volt, 3 ph, 1800 R.P.M. ball brg. Nema frame, explosion proof Howell elec. motor.

Mr. Kracht
The Visking Corporation
6733 West 65th Street
Chicago 38, Illinois.

WANTED: PLASTIC TOILET SEATS—Old established toilet seat manufacturer is interested in adding plastic toilet seats to our regular line. We are in a position to contract for large quantities. Full consideration will be given to complete seats as well as any development that has possibilities. Reply Box C805 Modern Plastics.

A LEADING PLASTIC MANUFACTURER located in central New England has opening for experienced supervisor of injection molding department. Must be thoroughly grounded in mold design and operation of injection machines. Give full details of experience, salary desired. Replies will be held in strict confidence. Reply Box C806 Modern Plastics.

FOR SALE

8 Rotary 16-punch preform presses; 2 Thropp two-roll Mills 16" x 30"; 6 jacketed double arm heavy duty mixers 50/250 gal. Also grinders, filters, kettles, tanks, pumps. PERRY EQUIPMENT CORP., 1529 W. Thompson St., Phila. 21, Pa.

FOR SALE

Munson Mill Machinery type 2 mixer all steel construction, approx. 62 cu. ft. volume, charge door in center, section, quick open discharge valve. Complete with 5 HP motor, 3 groove V-belt drive. Interested parties will be furnished photograph of mixer, if desired, prior to actual inspection of unit located in our Terre Haute, Indiana plant. Mr. Kracht, The Visking Corporation, 6733 West 65th Street, Chicago 38, Illinois.

VINYL PLASTIC FILM 54" 6 gauge translucent Pink & Green, about 1,000 yds. each. 4 gauge opaque about 700 yds. each grey, brown, beige. Swatches on request. Will accept reasonable offers, subject to prior sale. Reply Box C773 Modern Plastics.

CLOSE-OUT—
POLYSTYRENE SHEETING

9,000 lbs. .010 Polyflex in rolls 1,000 ft. long 20" wide in original packages as made and shipped by Plax Corp. available at half price 44¢ per lb., due to change in line. Subject prior sale in order received. Contact E. C. Gaymann, Interstate Folding Box Co., Middletown, Ohio.

AVAILABLE PRODUCTION SPECIALIST—31. B.A. in business administration. 9 years diversified experience with custom molders in handling sales service, plant operations and technical problems. Has knowledge materials and product application, production and cost control. Proven record. Presently employed, desires position with aggressive concern. Prefers to locate in middlewest. Reply Box C803. Modern Plastics.

WANTED

PLASTIC SCRAP

Clear Lucite HM 129

Reply Box C798, Modern Plastics

1—HYDRAULIC MOULDING PRESS #P-102-D Mfgd. by Otto Biefield Co. for Hulbert Engineering Co. Min. 10 ton Max. 30 ton. 12" Stroke—Draw Cylinder, 10" Stroke—Clamping Cylinder, Bed. 20" x 29". Other specifications on request. Price $1200.00. Reply Box C811 Modern Plastics.

HYDRAULIC PRESS — Laboratory model—hand operated—35 ton working capacity, 10" x 10" electrically heated platens, Used less than 50 hours. Write Mr. Chapin, 18476 Ferguson, Detroit 19, Michigan.

CHICAGO EXECUTIVE will conduct office on a part time basis for a growing concern maintaining or contemplating Chicago headquarters and not requiring a full time executive to carry out accounting, taxation, office and corporate procedures. Highest credentials. Reply Box No. C807, Modern Plastics.

FOR SALE: Electronic Heat Sealer (Model D1C 1KW Illinois Tool Works). Same as new, used under 100 hours. First reasonable offer accepted. Reply Box C808 Modern Plastics.

PLASTIC SALESMAN for old established plastic extrusion house. Salary and commission to versatile and experienced man. State all qualifications in first letter. All replies held confidential. Reply Box C809 Modern Plastics.

FOR SALE

1—Hungerford Plastimaker type 150 H.H. complete with drive, control panel, Toledo scale, plasticizer tank, air heater tank, electrically heated temperature controlled cone enclosure, extra spray guns, three sets of cintered bronze end plates. This equipment was used for experimental work and is in excellent operating condition. Reply Box C812 Modern Plastics.

PLASTIC EXTRUDER

2½" National Rubber Oil Heated Extruder Reliance Drive, Good condition. Can be seen in operation. Best offer. Reply Box C813 Modern Plastics.

POSITION WANTED—12 years experience in injection molding, sales engineering, product design, estimating, mold design, production supervision, some experience in tool and die work, plant set up, and brief experience in compression molding. 35 years old, married, one child. Reply Box C815 Modern Plastics.

IMMEDIATE DELIVERY

Baker Perkins Heavy Duty 100 gallon Double Arm, Steam Jacketed Mixers.

Readco Heavy Duty 150 gallon Double Arm, Steam Jacketed Mixers.

Stokes and Colton Rotary Tablet Machines

Mikro 24", 1 SH, Bantam Pulverizers.

Mixers of all types, Dryers, Grinders Automatic Cellophane Wrappers.

Many Other Items of Interest In Stock—Attractively Priced

Union Standard Equipment Co.
318-322 Lafayette Street
New York 12, N. Y.

WANTED: PLASTIC MATERIALS AND manufactures by mfrs. representative for foreign markets and Northern California. P. O. Box 1320, San Francisco.

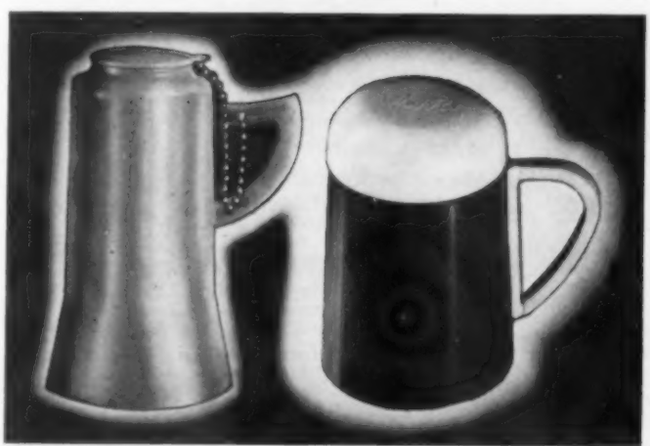
FOR SALE: 100,000 feet Textolite tubing, a paper base phenolic laminate, with desirable mechanical, electrical and chemical properties. 5" outside diameter, 4½" inside diameter ¼" wall. Length of clear sections 9' 6". This material was manufactured for the Government by General Electric. It has not been subject to use. Will withstand in excess of 500 p.s.i., can be threaded, drilled, etc., and is not subject to corrosion. Available at a low fraction of original cost. Prices, specifications and sample section on request. Box C814 Modern Plastics.

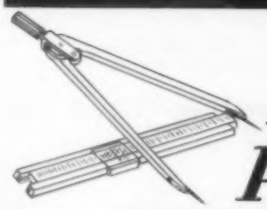
This is our new home...

with new and additional equipment to serve you even better for your Beryllium copper cavity and core requirements.

WE produce cavities and cores only! WE are not in competition with you...

11471 KERCHEVAL DETROIT 14, MICHIGAN
PHONE VALLEY 1-5210





PAST... PRESENT

Dee's Half Pint, small boys training pot, designed and molded by Anfinsen for Givens & Company of Clarendon Hills, Illinois. We created the original Half Pint years ago and recently re-designed this famous product into a more compact and efficient unit. Take advantage of our engineering and designing facilities.

ANFINSEN
PLASTIC MOLDING
New York Street
AURORA, ILLINOIS

EXTRUDERS
BY
MPM
OFFER

Control

MPM offers six-zone control of electrically heated cylinders with nine-eleven or fifteen separate cooling zones for removal of frictional heat or for fast cooling. Higher temperatures—higher screw speeds—higher production—per machine.

Flexibility

These *Modern* machines are furnished electrically heated but can be heated or cooled by steam, oil, water etc. Interchangeable heads and dies to produce covered wire, tubing, rods, strips, wide sheeting are also available along with conveyors, granulators, dryers, etc.

Leadership!

Modern engineering and specialization has resulted in the installation of these machines with 18 of a possible 20 leading material suppliers during the past two years. More complete cooperation with foreign customers too has made MPM the largest exporters of Extruding equipment during the same period.

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MODERN PLASTICS

PUBLISHED BY MODERN PLASTICS, INC. • 122 EAST 42nd STREET, NEW YORK 17, N. Y.

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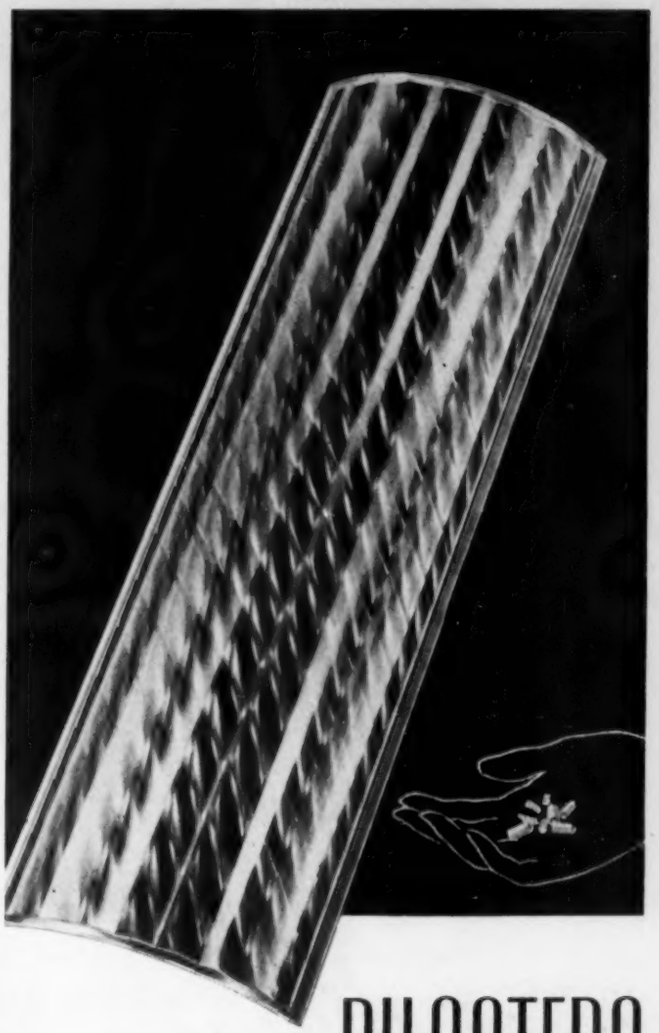

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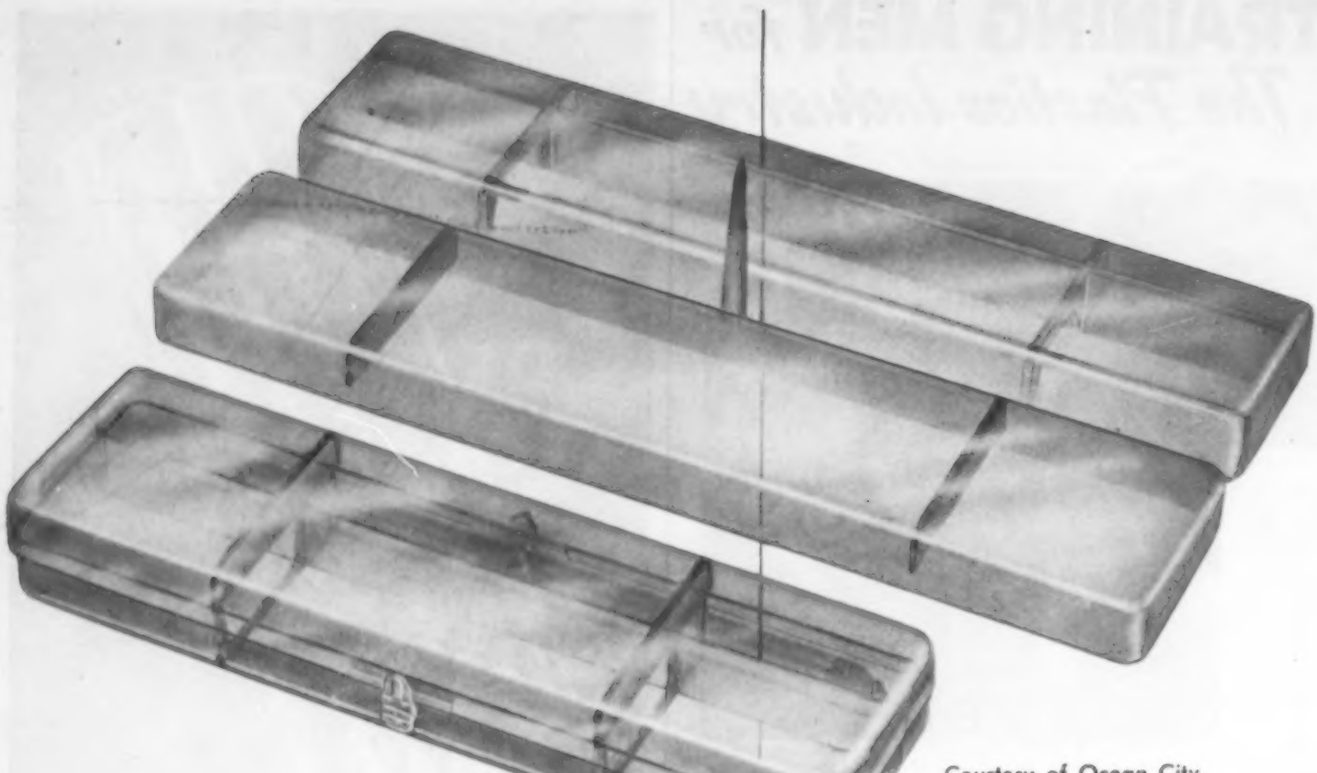

Courtesy of Ocean City Manufacturing Company

A whale OF A MOULDING THAT DIDN'T get away

Frequently an injection moulding job encounters engineering difficulties or lack of proper facilities, and then "gets away" because of the huge size of the moulding itself. However, our moulding of Ocean City's tackle boxes is a fishing and a plastic story with the opposite kind of an ending. We "landed" the tops and bottoms of two Ocean City boxes successfully — one 4½ inches wide by 1⅜ deep by 16 inches in length and the other 20 inches long, weighing almost two pounds. Credit for overcoming a decided number of difficulties, to the complete satisfaction of the customer, can be shared equally by our designing and die making engineers, and by our skilled moulders and finishers. These advantages, which belong wholly to our clients, have saved many a new customer the trouble of fishing around for a solution to a plastic problem. We're anxious to have you make use of them.

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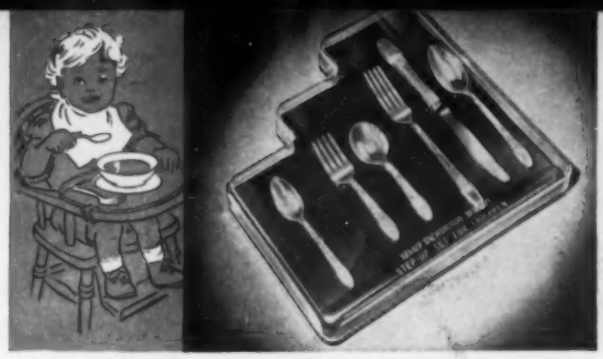

CLEAR VIEW PACKAGING

• Packaging beauty worthy of a beautiful gift! International Silver Company's new chests for its famous 1847 Roger Bros. Silverplate for children, are molded of exquisitely colored and sparkling clear BAKELITE Styrene Plastic—to last for keeps! Plastics that are fitting guardians for a growing child's treasured silver "Step-Up Set." *Molder:* F. J. Kirk Molding Co.

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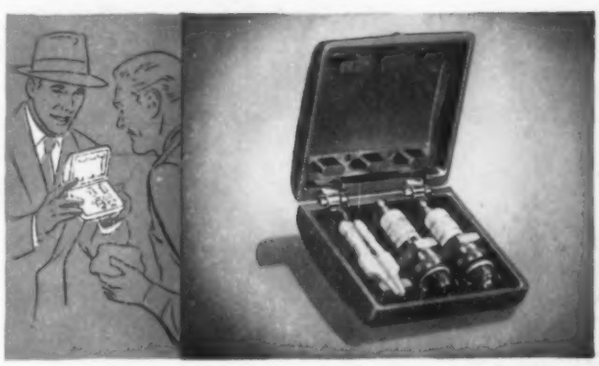

DURABLE DEMONSTRATOR

• To spark sales of Hastings Aero-Type Spark Plugs, Hastings salesmen carry samples in this handy case molded from BAKELITE Phenolic Plastic in attractive maroon finish. It holds a cutaway plug, an unassembled plug, and a finished one. It gives leadership display to a leadership product. It has a permanently rich appearance that defies soiling despite constant use. But its special value lies in its saving in costs over less durable cases formerly used. *Molder:* Industrial Molded Products Co.

DUAL-USE GIFT BOXES

• Hickok employs BAKELITE Plastics to advantage for its dual-use package for belts and buckles. Note the intricate detail of the latticework openings in the covers, and the finely molded decorative effects. The packages serve as handy boxes and ashtrays for a man's dresser after he's put the belts and buckles to work. You'll agree this is excellent merchandising—with plastics! *Molder:* Ontario Plastics Co.

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• More than just a package, the box for Sawyer's "View Master" three-dimensional color-slide viewer is a lifetime protective case for the instrument, plus a permanent library for your collection of picture reels. Made inexpensively of BAKELITE Styrene Plastic, the box has a smooth, lustrous, colorful finish, along with strength, and a permanently tight cover in contrasting color. *Molder:* Beaman Plastic Products Co.

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